HSL-WISVCUP
Ragsdale Bodymaker
Servo Cupfeed Control
User's Manual

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WARNING

To ensure that the equipment described by this User Manual, as well as the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. This includes the National Electrical Code in the USA and other applicable legislation, regulations, and codes in practice elsewhere. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standards and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

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The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation, operation, or adjustment of the equipment.

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SECTION 1
GENERAL DESCRIPTION

This section describes the features of the HSL-WISVCUP Servo Cupfeed control package. This includes the functional description, alarms detected, interlocks between the control package and the existing control system, etc.

1.1 FEATURES

- Provides Servo motor driven positive cupfeed cam control for APM Positive cupfeed cam upgrade.

- Interfaces directly with cupfeed cam servo motor, machine mounted main crank resolver, and existing control system to accurately cam cupfeed with main crank in all modes and all speeds.

- Immediate cupfeed cam stop at detection of short can or tear-off protects valuable tooling by preventing the feeding of an additional cup.

- Completely automatic synchronization of cupfeed cam with main crank shaft when clutch is engaged to reduce down-time and reduce operator manual interaction.

- Optional high speed logic functions add-on performs additional high speed control functions of Ragsdale Bodymaker including cupfeed solenoid control, air strip control, as well as die protection (short can detection).

- Alarm detection: cupfeed following fault, cupfeed servo motor o'temp, cupfeed motor amplifier fault.

- Provided with Windows and DOS based set-up software packages. This allows all user selectable parameters to be set using easy to use menus as well as download the respective application programs and set-up data.

- Based on the high performance M4510 PLC/PLS/Motion control module. This allows easy trouble-shooting and user customization using SYSdev (DOS-based) programming package.

SECTION 1
GENERAL DESRIPTION

1.2 FUNCTIONAL DESCRIPTION

The HSL-WISVCUP Bodymaker servo cupfeed control package is an electronic upgrade package used in conjunction with the Ragsdale servo positive cupfeed upgrade. It provides complete motion control of the servo cupfeed cam plus detection of the following alarms: cupfeed motor over temp, amplifier fault and cupfeed cam following fault.

The package interfaces directly to the machine mounted cupfeed servo motor, cupfeed timing sensor, main crank resolver, as well as the host PLC via discrete DC I/O.

The control system is not a dedicated "black box", but is instead implemented using the high performance SYSTEMS M4510 PLC/PLS Motion control module. This allows easy customization by either SEA or the end user. The M4510 module is programmed using the DOS-based SYSdev programming package. This allows the module to be programmed in any combination of Ladder or High-level (subset of "C"), as well as perform on-line monitoring and trouble-shooting.

1.3 CUPFEED CAM SERVO MOTOR CONTROL

The cupfeed cam motor control is implemented with a high speed (0.5msec update) PID servo loop. The main crank position is used as the reference for the servo loop with the cupfeed cam position used as the feedback. Both main crank position and cupfeed cam positions are generated with resolvers to provide the highest degree of reliability and noise immunity. Both resolver format signals are converted to digital with a resolution of 12-bits (0-4095). The PID servo loop nulls the error (difference) between the main crank and cupfeed positions to zero (or as minimal as is practical). Full access to the PID gains allows the servo loop to be tuned to provide the optimum balance between acceptable error and minimum running current.

At the detection of a short can or tear-off, the cupfeed cam is immediately stopped to prevent the feeding of an additional cup which protects valuable tooling. The cupfeed cam automatically synchronizes with the main crank when the machine is re-started to minimize down-time and eliminate manual timing by the operator.

The cupfeed cam is activated by the clutch solenoid control of the existing control system. The "HSL-WISVCUP" is interlocked to the existing clutch solenoids via redundant positively guided relays with self-check to maximize safety. The cupfeed servo motor is enabled via a contactor driven by these relays and thus incorporates the same level of safety typically provided with dual clutch solenoids with hardware interlocks.

1.4 ALARM DETECTION

The package detects the following alarms:

Cupfeed Following Fault: This alarm occurs when the cupfeed cam following error (difference between main crank position and cupfeed cam position) exceeds a user defined preset. This indicates either binding in the cupfeed cam, miss-tuning of the PID gains, broken belt, etc.

Cupfeed Amplifier Fault: This fault is generated by the B25A20 Cupfeed amplifier directly. Sources of this fault include: amplifier output short circuit, amplifier over-voltage, amplifier over temperature.

Cupfeed Motor Over Temp: Activated by the thermostat in the cupfeed servo motor. This fault occurs when the temperature of the motor exceeds 155° C.

The above alarms are available to the host PLC via discrete outputs. These should be used to stop the machine and indicate the problem when any one of the alarms occurs. In addition, the alarms are summed into the "Machine Run Enable" output which is available to the host PLC via a discrete output. This should be used to stop the machine when any one of the alarms occurs.

1.5 INTERLOCKS TO EXISTING CONTROL SYSTEM

In addition to the alarms listed in section 1.4, the following interlocks are +24VDC Discrete signals which should be interlocked to the existing control system:

Machine Run Enable: This signal is the summation of all the alarms in section 1.4. When "ON", all alarms are clear and the machine is enabled to stroke. When "off", one or more of the alarms is active and the machine must be stopped and disabled from running.

Cupfeed Enable: This signal indicates to the existing system when the cupfeed is synchronized with the main crank and thus, if the existing system is ready, cups can be feed into the machine. This signal typical turns "on" within one stroke after the clutch is engaged in continuous or inch mode when the cupfeed has synchronized with the main crank and stays "on" until a short can is detected or the cupfeed cam is manually moved out of time with the crank.

1.6 INTERLOCKS FROM EXISTING CONTROL SYSTEM

The following interlocks must be provided by the existing control system:

Run Mode (Wire 544): This is an input to the HSL-WISVCUP controller which should be on when "Cont." or "Inch" mode is selected. This can be mapped from an output of the existing PLC. See the suggested existing PLC ladder logic in Appendix A.

Run Mode (Wire 526): This is a hardware interlock which must be derived directly from the RUN/BAR selector switch of the existing system. This interlock disables the cupfeed servo motor contactor when in BAR mode and thus provides the function of safety interlock when bar mode is selected.

Short Can Alarm: This is an input to the HSL-WISVCUP which should be mapped from an output of the existing PLC and should be "on" when a short can is detected by the existing PLC. This input stops the cupfeed cam immediately and prevents another cup from being fed into the machine.

Alarm Reset: This is an input to the HSL-WISVCUP controller which can be mapped from an output of the existing PLC and should be "on" while the "Alarm" reset push-button of the existing system is depressed.

Clutch On: This is an input to the HSL-WISVCUP which can either be mapped from an output of the existing PLC which is "on" when the clutch is "on", or can be derived directly from one of the clutch solenoids (assuming +24VDC solenoids are used).

1.7 OPTIONAL HIGH SPEED LOGIC

In addition to performing the standard cupfeed cam control, the HSL-WISVCUP package can be upgraded to perform additional high speed logic functions of the bodymaker by purchasing the optional HSL-WI6 package.

The HSL-WI6 option package performs the following:

- Additional high speed functions of the Ragsdale Bodymaker including cupfeed solenoid control, air strip control, as well as die protection (short can detection)

- Accurate short can detection to a resolution of 1/4" can length. Short can detection incorporates immediate stop of the cupfeed cam and cupfeed solenoid to prevent the feeding of an additional cup.

- Highly repeatable air strip control to reduce can stripping and blow-out problems.

- Brake Wear compensation (Auto BDC timing programming) algorithm to stop press at BDC regardless of brake response. Brake response determination allows displaying of actual brake response (in degrees). Brake response alarm to indicate when brake stopping response (in degrees) has exceeded user preset.

- Trimmer speed reference (0-10volt analog output) provides reference to trimmer proportional to speed of bodymaker (user scalable).

- Data Acquisition: Total number of good cans produced and total number of short can faults (for both the current shift and last shift).

- Built-in 2 Line X 40 character sealed display with 24 key membrane keypad allows local viewing of collected data (good can count, short can count, brake response) by operator and set-up of some user variables (passcode protected) by authorized personnel.

- Built-in PLS provides all machine timing, eliminating need for additional PLS.

The HSL-WI6 consists of an additional I/O board which is added to the M4510 module, pre-wired field wiring arm for the I/O board, D4591 Keypad/Display, HSL-WI6 User manual, and the high speed logic program "HSLSCUP6" which is loaded into the main processor of the M4510 (replacing the "HSLSCUP" program).

The HSL-WI6 option package can be used to enhance the performance of the APM Bodymaker or to reduce the program modifications required to the existing PLC when upgrading a standard from a standard cupfeed to the positive cupfeed.

SECTION 2
INSTALLATION

The HSL-WISVCUP package is provided in a self contained NEMA 12 enclosure for mounting adjacent to the existing control cabinet.

2.1 WHAT'S INCLUDED

Verify that the following items are included when unpacking the HSL-WISVCUP:

- 1ea. HSL-WISVCUP NEMA 12 enclosure including the following:
  - 1ea. M4510 PLC/PLS module
  - 1ea. P4500 Power Supply
  - 1ea. B25A20 Servo Amplifier
  - 1ea. PS300W-96V Servo Power Supply
- 1ea. MPM892FRMM-B 3" Servo Motor
- 1ea. Bi4-M12-AP6X-H1141 Timing Sensor
- 1ea. WK 4T-6 Sensor Cable
- 1ea. 4-Conductor Servo Motor Power Cable
- 1ea. 8-Conductor Servo Motor Feedback Cable
- 1ea. HSL-WISVCUP User's Manual
- 1ea. M4510 User's Manual
- 1ea. HSL-WISVCUP Program Disk

The following items can be purchased separately as required or desired. All items are compatible with both the back-panel mountable package or the NEMA 12 enclosed package:

- 1ea. HSL-WI6 High Speed Logic Option
- 1ea. RSV34-MS1 Resolver
- 1ea. RSV-RSCBLE-XX Resolver Cable

SECTION 2
INSTALLATION

2.2 POWER REQUIRED

The HSL-WISVCUP is powered from 115VAC 50/60HZ and +24VDC. The 115VAC is used to power the M4510 module and B25A20 Cupfeed Servo amplifier while the +24VDC is used to power the +24VDC I/O (sensors, discrete interlocks, etc.). Current required from the 115VAC line is 2.5 Amps (with a 6 Amp peak at power up). Current requirements from the +24VDC power source is less than 0.5 Amps.

The input power should be derived from the existing control system (or at least interlocked with the existing control system) such that when the main disconnect of the existing control system is turned "off", all power to the HSL-WISVCUP is also turned "off".

2.3 MOUNTING THE HSL-WISVCUP

Mount the HSL-WISVCUP NEMA 12 enclosure in proximity to the existing control cabinet. Mount the MPM892FRMM-B cupfeed servo motor on the mounting bracket supplied with the mechanical portion of the Ragsdale servo cupfeed upgrade package. Mount the Bi4-M12-AP6X-H1141 timing sensor on the mounting bracket supplied with the mechanical portion of the servo cupfeed upgrade package.

2.4 WIRING THE HSL-WISVCUP

Referring to the electrical control schematic at the back of this manual, wire the HSL-WISVCUP as follows:

1) Incoming Power (115VAC - Wires 803, 801, 900 and +24VDC - Wires 501 and 500)

2) Interlocks between existing control system and HSL-WISVCUP (Wires 544, 545, 546, 547, 550-557, FLT1, and FLT2)

3) Clutch interlock wiring (Wires 512, 513, 518, 519, and 526)

4) Cupfeed timing sensor (Wires 510, 501, and 500)

5) Cupfeed Motor - both stator and feedback using supplied 4-conductor and 8-conductor cable.

   Note: Individual conduit runs (Liguidtight) should be provided for the 4-conductor motor leads and the 8-conductor resolver feedback cable to reduce EMI pick-up on the resolver leads. Figure 1 shows an example of using a "T" conduit fitting to separate the two conduits. If only one Liquid-tight run is made to the motor, run it to the nearest junction box and then separate the two runs.

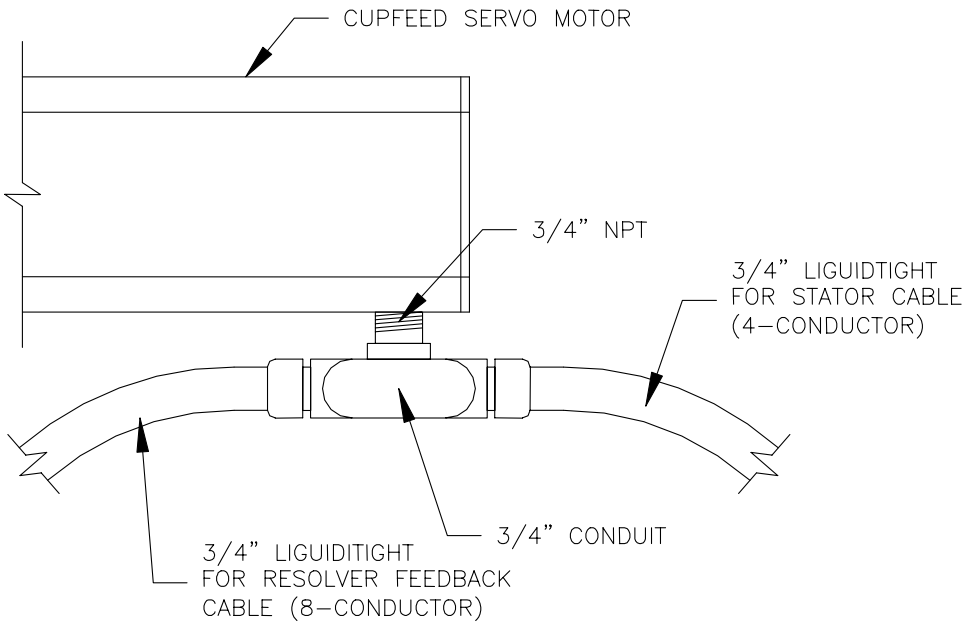


Figure 1 - Cupfeed Motor Conduit Routing

6) Main Crank Resolver. If machine is already equipped with a resolver, parallel resolver wiring with existing PLS (R2 of the M4510 is reference ground). If machine is not equipped with a resolver, see section 2.5 – Mounting the RSV34-MS1 Resovlver.

In general, when wiring the HSL-WISVCUP, keep all +24VDC and resolver wiring away from high voltage wiring.

2.5 MOUNTING THE RSV34-MS1 RESOLVER

The HSL-WISVCUP is designed to interface to a resolver (not encoder) for machine timing. If the machine is not already equipped with a resolver, then the existing encoder will have to be removed and an RSV34-MS1 resolver will have to be mounted in it's place. If this is the case, refer to the RSV34-MS1 data sheet for details on mounting the resolver. Use the RSV-RSCBLE cable to connect the resolver to the HSL-WISVCUP. Route the resolver cable in a separate conduit, away from all other high voltage and control wiring. Wire the cable directly to the 8-pin resolver connector on the M4510.

2.6 HSL-WISVCUP SOFTWARE INSTALLATION

Follow the steps below to install either the Windows or DOS based setup programs and PLC application program on a PC used to support the HSL-WISVCUP control system.

2.6.1 WINDOWS™BASED SETUP PROGRAM INSTALLATION

The WISVCUP setup program is compatible with Windows 95/98/ME/2000/XP operating systems and is used to:

1) Setup (tune) the user adjustable variables
2) Adjust the timing channel set-points
3) Download the application programs to the M4510 and S4520
4) Download (restore) or upload (save) the user setup variables
5) View "Shift" data.

To install the set-up software, perform the following steps:

1) Insert the HSL-WISVCUP CD into the drive

2) From the Windows desktop, "Click" Start and then select run.

3) From the "Run" dialog box, "Click" the Browse button.

4) Select the drive with HSL-WISVCUP CD. Select the "setup.exe" file and "Click" Open and then Ok.

5) This will initiate the installation process. Follow the instructions that appear on the screen to complete the installation process. The WISVCUP setup program can be executed from the "Systems" folder located in Programs.

2.6.2 DOS BASED SETUP PROGRAM INSTALLATION

The HSL-WISVCUP set-up software is used to:

1) Download the program to the M4510 module
2) Tune (set-up) the user adjustable variables of the HSL-WISVCUP.
3) Download (restore) and upload (save) the user set-up variables

To install the set-up software, perform the following steps:

1) Create one directory off the root for the HSL-WISVCUP called "HSLSCUP". This will be used to store:
   - The "HSLSCUP.EXE" setup program
   - The HSL-WISVCUP application programs
   - The HSLSCUP set-up data for each bodymaker

   Create this directory by typing the following at the DOS prompt:

   MD \HSLSCUP<ENTER>

2) Install the disk labeled “HSL-WISVCUP PROGRAMS” into the drive, switch to that directory and install the “HSL-WISVCUP” programs by typing the following at the DOS prompt:

   CD \HSLSCUP<ENTER>
   A:INSTALL<ENTER>

3) Add the HSL-WISVCUP set-up program to your computer's menu software by creating a selection called "B/M SERVO CUPFEED". The DOS commands executed for these selections should be:

   For the "B/M SERVO CUPFEED" selection:
   CD \HSLSCUP
   HSLSCUP
   CD \

4) To execute the servo cupfeed set-up program, simply select the corresponding "B/M SERVO CUPFEED" selection from the menu software's menu.

2.6.3 SYSdev PROGRAM DEVELOPMENT SOFTWARE INSTALLATION

The SYSdev Program Development software is used to perform on-line trouble-shooting and program modifications to the HSL-WISVCUP. If SYSdev was purchased with the HSL-WISVCUP package and is not already installed on the your computer, install SYSdev onto the hard drive of your computer following the steps in outlined in the SYSdev Program Development manual.

2.6.4 APPLICATION PROGRAM INSTALLATION

The application program is a SYSdev based program, loaded into the M4510 module and the S4520 motion control board. These programs perform the HSL-WISVCUP logic. The programs are written in a combination of Ladder logic and High-level. If the user desires to make program changes or perform on-line monitoring of the programs that constitute the HSLWISVCUP program, the application programs will have to be loaded onto the hard drive of the PC used to support the system. The SYSdev Program Development Software will also have to be loaded on the PC. To install this program perform the following:

1) Install the “PROGRAMS” disk into the drive.

2) For each of the " HSLSCUP " directories (created in section 2.6.2), copy all the files from the disk to each of these subdirectories.

2.7 MODIFY EXISTING PLC PROGRAM

Modify the existing control system PLC program to interface with the HSL-WISVCUP by incorporating the following into the existing PLC ladder logic:

1) Add the "Run Mode" output into the existing PLC logic. This should be "Continuous Mode" OR'd with "Inch Mode" ANDed with in "Run Mode". Add the "Clutch On" output as well which should be "on" when the clutch is activated.

2) Add the "Alarm Reset" output. This should be driven directly by the Alarm Reset push-button of the existing system.

3) Add the "Short Can Alarm" output. This should be driven directly by the short can alarm detection logic of the existing system and should go "on" immediately when the short can is detected and should stay "on" until reset.

4) Add the "Machine Run Enable" input from the HSL-WISVCUP into the existing system. This sums all the HSL-WISVCUP alarms into one input that should disable the cupfeed and stop the machine at BDC. In addition, outputs from the HSL-WISVCUP are available for each individual alarm. These can be input to the existing PLC as well so they can be displayed on the existing alphanumeric display, etc.

5) Add the "Cupfeed Cam In Sync" input from the HSL-WISVCUP into the existing system. This is "on" when the cupfeed cam is in sync with the main crank and should be interlocked with the cupfeed enable logic to prevent the feeding of cups when "off".

Refer to the suggested existing PLC ladder logic at the back of this manual as an example of how the existing PLC ladder logic might be modified for the previous interlocks.

2.8 POWER UP HSL-WISVCUP

With the wiring to the HSL-WISVCUP complete, apply power and verify the following:

1) Green "PWR" and "RUN" LEDs on M4510 main processor are "on" and red "FLT" LED is "off".

2) Green "PWR" and "RUN" LEDs on S4520-RDC in M4510 slot 01 are both "on". Green "AMP ENB" LED is "off".

3) LED on B25A20 servo amplifier is "RED" (this is normal when the amplifier is disabled which it is until the cupfeed motor is actually running).

4) If the above is not as described, verify that power is applied to both the M4510 module and the B25A20 amplifier. Also verify all cables are connected properly the respective modules.

5) Using the set-up program, verify that the M4510 main processor is loaded with the "HSLSCUP" application program and that the S4520 in slot 01 is loaded with the "SRVCUPR" application program. See section 4 or 5 for details on using the setup program to verify these programs are loaded.

SECTION 2
INSTALLATION

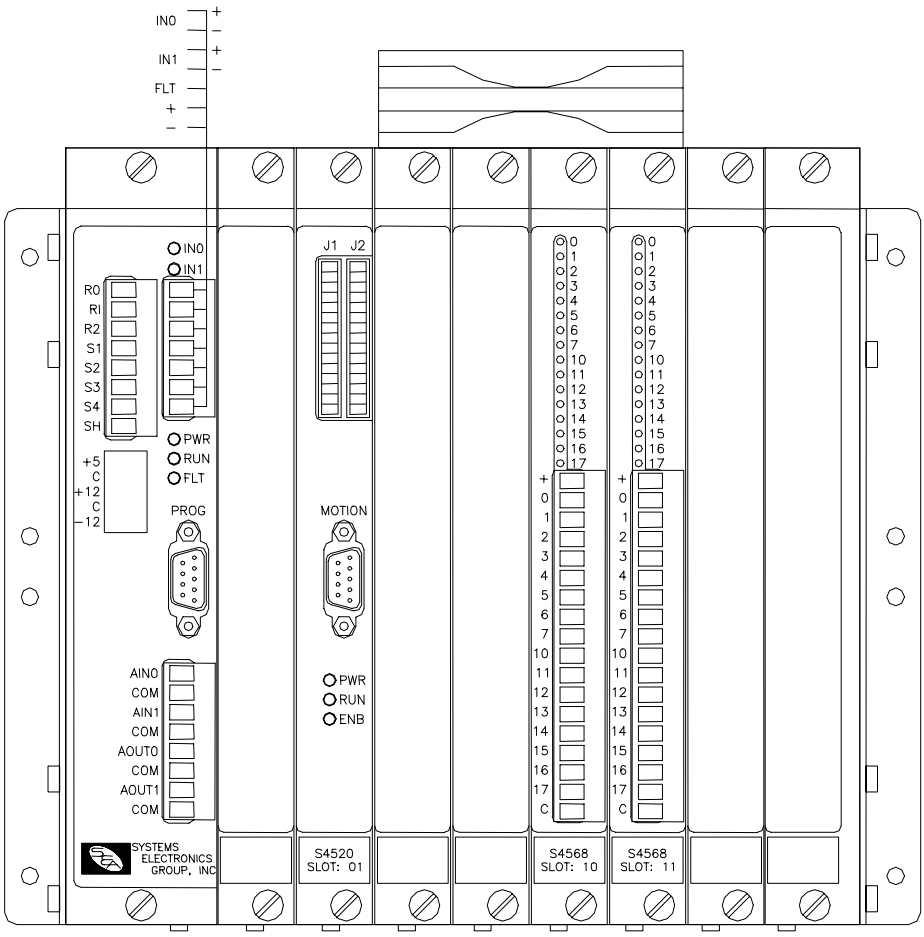


Figure 2 - M4510 Configuration

2.9 HSL-WISVCUP SET-UP

The HSL-WISVCUP is shipped from the factory with the PLC program "HSLSCUP" loaded in the main processor of the M4510 module (PLC section) and the PLS channel set-point file "TMGSCUP" loaded in the PLS section of the M4510 module. Program "SRVCUPR" is loaded in the S4520 motion controller located in slot 01 of the M4510. These are the standard programs used to implement the standard HSL-WISVCUP servo cupfeed algorithm.

In some cases, the following user variables and timing channels may have to be altered to tune the HSL-WISVCUP to the actual bodymaker it is controlling.

Once the HSL-WISVCUP is installed and the control system is powered back up, perform the following to set-up and tune the HSL-WISVCUP. The set-up is performed using a PC running the set-up program. See section 4 or 5 for a description of the menus and variables and how to use the setup program.

2.9.1 DEFAULT SET-UP VARIABLES

As shipped, the set-up variables for the S4520-RDC motion control processor in slot 01 are set to the following defaults:

Cupfeed Stop Position at Short Can: _____: 1950

Synchronization Error Limits:
- Max Error for "Out of Sync" Disable: _____: 100
- Max Error for Enable Cupfeed Synchronization: _____: 500
- Max Error for "Following Error" Alarm: _____: 050

Cupfeed Servo PID Gains:
- Proportional Gain (P): _____: 15.0
- Integral Gain (I): _____: 100
- Derivative Gain (D): _____: 25

The above default set-up variables are stored in the data file for Bodymaker 00.

2.9.2 VERIFY SERVO CUPFEED SET-UP PARAMETERS

Using the set-up program, verify that the user variables of the S4520-RDC in slot 01 of the M4510 are set to the defaults as out-lined in section 2.9.1. If they are not, download the default set-up parameters for bodymaker #00. These may be changed once the servo cupfeed is run, but should be set to the defaults to start out. Refer to section 4 or 5 for details on observing these variables and downloading these variables using the setup program.

2.9.3 VERIFY MAIN CRANK RESOLVER

From the "Cupfeed Cam Time/Position Diagnostics" menu of the setup program, observe the actual main crank position. Verify that the main crank resolver direction is correct and is linear by barring or inching the machine forward. The position should increment linearly through the range of 0 to 4095. If the direction is backwards, reverse the S1 and S3 leads of the resolver where they connect to the M4510 module. If the position is not linear (increments up then down or does not increment through full range), verify that the resolver leads are all connected correctly.

2.9.4 SET MAIN CRANK ZERO

Inch the main crank of the bodymaker to back dead center (BDC) and set the M4510 offset by pressing the "Zero Main Crank" push-button inside the HSL-WISVCUP enclosure.

2.9.5 VERIFY CUPFEED CAM RESOLVER

From the "Cupfeed Cam Time/Position Diagnostics" menu of the setup program, observe the actual cupfeed cam position. Verify that the cupfeed resolver direction is correct and is linear by pulling the cupfeed cam forward by hand. The position should increment linearly through the range of 0 to 4095. If the direction is backwards, verify the resolver is wired per the schematic at the back of this manual. If the position is not linear (increments up then down or does not increment through full range), verify that the resolver leads are all connected correctly.

2.9.6 TIME CUPFEED CAM TO MAIN CRANK

Prior to timing the cupfeed cam with respect to the main crank, pull the cam forward through at least one complete revolution with the target on the cam passing the timing sensor.

Perform the following to time the cupfeed cam with respect to the main crank:

1) Inch or bar the ram to the position where the punch has just opened to the point where the cup could first be loaded (this is when the ram is on the back stroke). See figure 3.

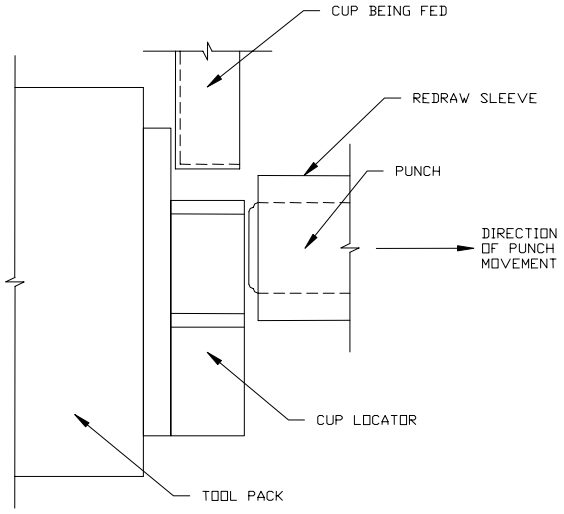


Figure 3 - Location of Ram at "Cupfeed Time" Position

2) Using the "Manual Cupfeed" push-button, feed one cup into the cupfeed cam and rotate the cam by hand until the cup is fully loaded into the cam. Rotate the cupfeed cam (with the cup loaded) into the position where the cup would first be loaded into the cup locator (see figure 4).

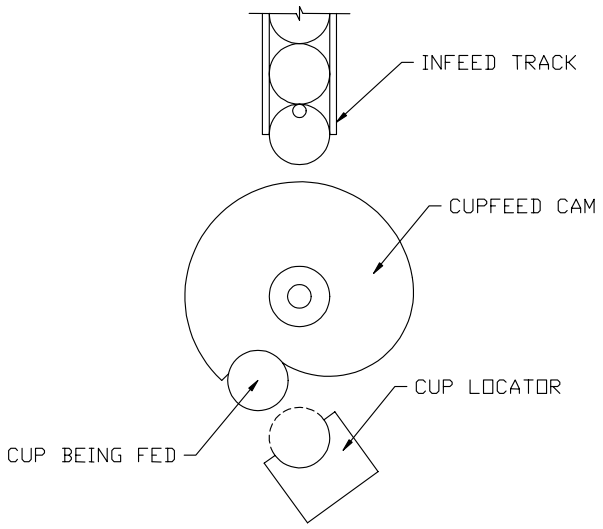


Figure 4 - Location of Cupfeed Cam at "Cupfeed Time" Position

3) With the cupfeed cam located as described above, press the "Home Cupfeed Cam" push-button inside the HSL-WISVCUP enclosure. Make sure the cupfeed cam does not slip from the "cupfeed time" position when performing this step.

4) At this point in time, the cupfeed cam is timed with respect to the main crank such that when the machine is running the cupfeed cam will be in sync with the main crank and load the cup when the ram has just opened up.

5) The previous steps will automatically set the "Cupfeed Cam Home Position" by calculating the cupfeed cam offset relative to the main crank position.

2.9.7 VERIFY CUPFEED TRACKING

By inching the machine, verify that the cupfeed does track (follow) the main crank. Verify that the cupfeed is correctly in time with crank in all crank positions.

If the cupfeed oscillates wildly or does not follow the crank, verify that the PID gains are set correctly (see section 2.9.1 – Default Set-up Variables). If the gains are set correctly, verify that the motor stator wiring and feedback wiring are correct (see schematic at the back of this manual). If they are correct, verify that the analog command reference from the S4520-RDC to the B25A20 is not swapped (see schematic at the back of this manual).

2.9.8 VERIFY MACHINE OPERATION

Run the machine in normal production (both at low and high speeds where practical) and verify that the cupfeed cam does track the main crank in both inch and continuous modes.

Note: After power-up, the cupfeed cam will automatically time itself when the machine is first run (in inch or continuous). The cupfeed cam will rotate at a slow speed until it passes the timing sensor and then will start tracking the main crank.

Verify that the cupfeed cam does stop immediately at the detection of a short can or tear off (no longer in sync with the ram). The position the cupfeed will stop at is set by the "Cupfeed Stop Position at Short Can" parameter (see section 4.6.1 – Windows Setup Program Reference or section 5.3 – DOS Setup Program Reference).

Verify that the cupfeed solenoid feeds cups properly.

Note: The positive cupfeed sequence is different than that of the standard cupfeed. With the positive cupfeed, the first can is punched on the second stroke after the cupfeed is opened. Two additional strokes will have to be made (with air strip and die protect enabled) after the cupfeed is turned "off" to process the cups in the cam. Modify the existing PLC die protect and cupfeed logic as necessary to achieve this. The HSL-WI6 high speed logic option performs the cupfeed logic as outlined in the preceding sequence.

Verify that the Cupfeed Cam is disabled in BAR mode. Activate the clutch in Bar mode and verify that the C1 contactor for the servo amplifier is not activated. This makes sure that the Cupfeed servo motor is disabled while activating the clutch in Bar mode.

The Machine Is Now Set-Up And Ready To Run!

2.10 MODULE/SERVO AMPLIFIER INSTALLATION/REPLACEMENT

The following is provided only as a reference. These steps are performed by the factory prior to shipping the HSL-WISVCUP. These steps need only be performed in the event the M4510 module, P4500 power supply, or B25A20 servo amplifier need to be replaced. Refer to the M4500 User's Manual for general details on installing the M4510 and P4500.

2.10.1 M4510 MODULE INSTALLATION

To install the M4510 module, perform the following:

1) Remove the cover from the M4510 chassis (retained with three captive screws on the lower front of the cover and two captive screws on each side of the chassis).

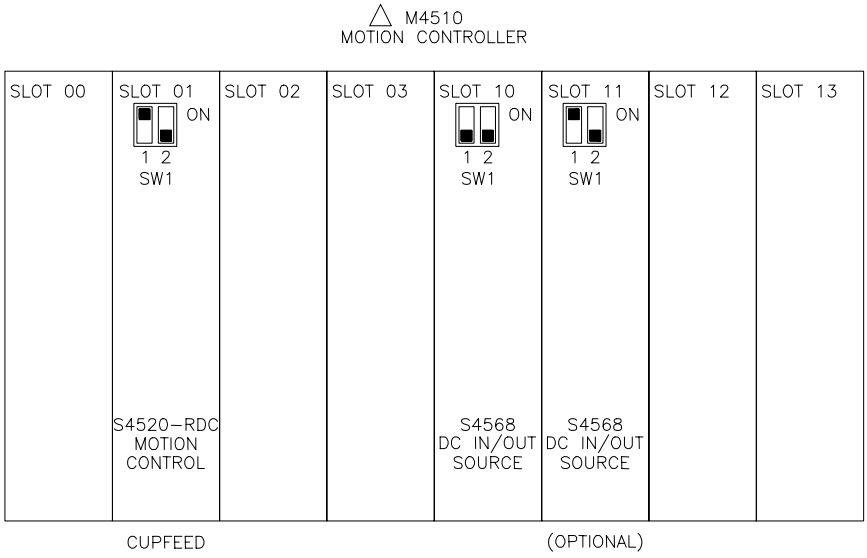


Figure 5 - S4520 and S4568 Dip Switch Settings

2) **Install S4520-RDC (SLOT0-1):** Set the slot address dip switches (SW1) on the S4520-RDC to the following positions (slot1):

S4520-RDC: SW1 switch1 = "ON"
SW1 switch2 = "OFF"

Install the S4520-RDC in Slot0-1 (second slot from the left) of the M4510 chassis.

3) **Install S4568 (SLOT1-0**): Set the slot address dip switches (SW1) on the S4568 to the following positions (slot0):

S4568: SW1 switch1 = "OFF"
SW1 switch2 = "OFF"

Install the S4568 in Slot1-0 (fifth slot from the left) of the M4510 chassis.

4) Install the cover back over the M4510, making sure all the board connectors protrude through the slots in the cover. Tighten the three captive screws on the lower front of the cover and the two captive screws on each side of the chassis.

5) Mount the M4510 chassis to the HSL-WISVCUP back panel using four 8-32 screws.

6) With power "off", install the P4500 power supply cable to the +5/C/+12/C/-12 connector on the M4510. The connector on the cable is polarized and should mate with the connector on the M4510 only one way.

7) Install the respective field wiring arms on all the I/O boards of the M4510 (I/O slots0-1 and 1-0). Make sure all the field wiring connectors are fully mated in the M4510.

8) Power-up the M4510 module and download the "HSLSCUP" program to the M4510 main processor (see section 2.10.4). Download the "SRVCUPR" program and data to the S4520-RDC in slot0-1 (see section 2.10.5).

2.10.2 P4500 POWER SUPPLY INSTALLATION

To install the P4500, perform the following steps:

1) Mount the P4500 to the HSL-WISVCUP in the mounting holes next to the M4510 (left side) using two 8-32 screws.

2) Install the P4500 power supply cable to the +5/C/+12/C/-12 connector on the M4510. The connector on the cable is polarized and should mate with the connector on the M4510 only one way.

3) With power to the P4500 L, N, G field wiring connector "off", connect this connector to the P4500 input power connector.

2.10.3 B25A20 SERVO AMPLIFIER INSTALLATION

To install the B25A20 Servo Amplifier, perform the following steps:

1) Set the dip switches on the B25A20 as follows:

1:	Test/Offset	OFF
2:	Loop Gain	ON
3:	Current Scaling	OFF
4:	Vel Loop Integrator	ON
5:	Duty Cycle Feedback	OFF
6:	Velocity Feedback	OFF
7:	Velocity Direction	OFF
8:	Cont Current Reduction	OFF
9:	Integrate Cap	OFF
10:	60/120 Phasing	ON

2) Verify both the "**Current Limit**" and "**Ref In Gain**" potentiometers on the B25A20 are turned fully clockwise for maximum gain (these are multi-turn pots and should be turned clockwise at least 14 times to ensure they are at the maximum gain settings).

3) Verify "**Loop Gain**" potentiometer on B25A20 is turned fully counter-clockwise (14 times) for minimum loop gain.

4) Remove the cover of the B25A20 and verify that the J1 jumper on the PC board has been removed (cut out). This is a zero ohm surface mount resistor. If it has not been removed, carefully cut it out with a pair of side cutters. This inverts the Inhibit input turning it into an enable input. Install the cover back on the B25A20.

5) Mount the B25A20 to the side of the PS300W-96V power supply using the supplied 8-32 hardware.

6) Wire the MOTOR A, B, and C stator leads to the P2 connector along with the high power and ground leads. Be sure to connect the MOTOR A, B, and C stator leads per the schematic at the back of this manual, otherwise the motor will not run correctly (jerk or stall).

7) Connect the P1 Molex connector to the P1 connector of the B25A20.

2.10.4 DOWNLOAD HSLSCUP PROGRAM AND SET-UP DATA TO M4510

Once the M4510 is installed, perform the following to download the HSLSCUP application program to the M4510 main processor as well as download the previously saved set-up data and timing channel set-points:

1) Power up the M4510 and the IBM PC or compatible used to interface with the HSL-WISVCUP.

2) Connect an RS-232 cable from the computer COM port to the "PROG" port on the M4510.

3) Execute the setup program (WISVCUP for Windows based systems, HSL-SCUP for DOS based).

4) If using the HSL-SCUP setup program, select the bodymaker (B/M number) that is being interfaced to. If using the WISVCUP setup program, open a previously saved setup data table file.

5) Select Bodymaker set-up (M4510 PROG PORT).

6) Download the HSLSCUP application program to the M4510. The current program ident, revision, and checksum for both the program to be loaded (on disk) and for the program already loaded in the M4510 will be displayed. Confirm your choice to start the download. See section 4.2.3 – Windows Setup Program Reference or section 5.2 – DOS Setup Program Reference for complete details.

7) Download the PLS timing set-points and setup data to the M4510. See section 4.2.4 – Windows Setup Program Reference or section 5.2 – DOS Setup Program Reference for complete details.

2.10.5 DOWNLOAD SRVCUPR PROGRAM AND SET-UP DATA TO S4520-RDC IN SLOT01

Perform the following to download the SRVCUPR application program to the S4520-RDC motion control processor as well as download the previously saved set-up data:

1) Power up the HSL-WISVCUP and the PC used to interface with the HSL-WISVCUP.

2) Connect an RS-232 cable from the computer COM port to the "MOTION" port on the S4520-RDC in slot 01.

3) Execute the setup program (WISVCUP for Windows based systems, HSL-SCUP for DOS based).

4) If using the HSL-SCUP setup program, select the bodymaker (B/M number) that is being interfaced to. If using the WISVCUP setup program, open a previously saved setup data table file.

5) Select Cupfeed Set-up (S4520 Slot-01 MOTION PORT).

6) Download the SRVCUPR application program to the S4520. Confirm your choice to start the download. See section 4.2.3 – Windows Setup Program Reference or section 5.3 – DOS Setup Program Reference for complete details.

7) Download the previously saved set-up data to the S4520-RDC. See section 4.2.4 – Windows Setup Program Reference or section 5.3 – DOS Setup Program Reference for complete details.

8) Verify that the cupfeed cam is timed correctly to the main crank (see section 2.9.6).

The HSL-WISVCUP is now ready to run, loaded with the application programs, timing set-points, and set-up data previously saved for the respective bodymaker.

SECTION 3
TUNING THE SERVO LOOP

This section describes the PID servo loop in general (as used with the cupfeed motor), provides definitions of the PID gains, plus tips on tuning the servo loop.

Note: The defaults PID gains have been determined to be the optimum gains. The PID gains should only be changed by qualified personnel familiar with closed loop servo control. Instability (oscillation) of the servo motor can result if the PID gains are set incorrectly.

3.1 DESCRIPTION OF PID SERVO LOOP

In the servo cupfeed application, the intention is to have the cupfeed track (follow) the main crank position as accurately as possible. This is accomplished using an individual S4520 motion controller implementing a PID servo loop for the cupfeed cam.

Essentially the PID loop determines the difference between the main crank position and the actual servo motor position and generates a torque to null the difference to zero (or as minimal as is practical). This is done continuously through out the main crank stroke. Full access to the PID gains allows the servo loop to be tuned to provide the optimum balance between acceptable error and minimum running current.

The servo motor control is implemented with a high speed (0.5msec update) PID servo loop. The main crank position is used as the reference for the servo loop with the servo motor position used as the feedback. Both main crank position and servo motor positions are generated with resolvers to provide the highest degree of reliability and noise immunity. Both resolver format signals are converted to digital with a resolution of 12-bits (0-4095).

The PID servo loop is implemented in the S4520 motion control processor of the M4510. This board interfaces to the servo amplifier which drives the motor. The S4520 motion controller provides a +/-10 Volt analog signal to the amplifier which is essentially a "torque" command.

SECTION 3
TUNING THE SERVO LOOP

The servo amplifier will supply a current to the servo motor which is proportional to the +/-10 Volt analog command. The servo motor in turn generates a torque to the load which is again proportional to this current. Thus the +/-10 Volt analog signal from the S4520 can be considered a “torque” command (both positive and negative torque) to the motor.

The stability and responsiveness of the servo motor is defined by the combination of the PID gains. These gains determine whether the servo loop is stable (under-damped, over-damped, or critically damped) or unstable (oscillatory). Each individual (P), (I), and (D) gain is used to generate an individual error term. The summation of these three error terms is the “torque” command that is applied to the servo amplifier which drives the motor.

In general, the gains are determined empirically by observing the response of the system (both step response and while running continuously) and adjusting the gains until the desired response (and required torque) are achieved. The gains are set using the set-up program. The following describes the individual (P), (I), and (D) gains and corresponding error terms.

3.2 PROPORTIONAL (P) GAIN

The proportional (P) gain is used to create an error term which is “proportional” to the difference between the main crank position and the servo motor position. The higher the proportional error term, the higher the torque generated to null the error. For a specific amount of error, the higher the (P) gain, the higher the torque generated.

Note: By itself, the (P) term cannot null the error to zero since a torque is only generated when there is a difference between the main crank position and servo motor.

The (P) gain is used in conjunction with the other gains to define the system stability and responsiveness. The higher the (P) gain, the higher the responsiveness.

Note: Too high of a (P) gain will cause the system to be unstable (oscillate) because the system cannot respond quick enough. Excessive current will also be drawn which is undesirable. Too low a gain will cause excessive following error to the point of instability depending on where the (I) gain is set. In general, the (P) gain is used to overcome high frictional loads (higher (P) for higher friction).

3.3 INTEGRAL (I) GAIN

The integral (I) gain is used to create an error term that is proportional to the cumulative difference (error) between the main crank position and servo motor position. Thus for a fixed amount of error, the torque generated due to the integral error term will continue to increase at a rate proportional to the (I) gain. The higher the integral error term, the faster the torque generated to null the error will increase. This term is used to null a fixed error to zero since a torque of whatever amplitude will be generated to null the error to zero.

Note: Without the other gains ((P) and (D)), the system would be unstable.

As with the (P) gain, the higher the integral gain, the higher the responsiveness.

Note: Too high of an (I) gain will cause the system to be unstable (oscillate) because the system cannot respond quick enough. Too low an (I) gain will cause excessive following error since at low (I) gains, the (P) gain would be mostly responsible for nulling the error. The system will not be unstable if the (I) gain is set to zero.

3.4 DERIVATIVE (D) GAIN

The derivative (D) gain is used to create an error term which is proportional to the rate of change of error between the main crank position and servo motor position. Thus for a fixed amount of error, the torque generated due to the derivative error term will be zero (rate of change is zero). This error term is only generated when the amount of error is changing. The higher the rate at which the error changes, the higher the derivative error term. This term is primarily used to stabilize the servo loop. It is used to reduce ringing in underdamped responses or to provide fundamental stability to loops that would otherwise be unstable.

There is a definite comprise between to much (D) gain and not enough (D). With too little, the system may go unstable or be marginally stable. Also excess ringing with a corresponding longer settling time to a step response will occur if the (D) gain is too low. If the derivative gain is too high, the system response will be reduced and high frequency oscillations may occur, not to the point of instability but to the point where higher current will be drawn and excessive high frequency torque will be applied to the load.

3.5 TUNING THE SERVO MOTOR WITH MACHINE RUNNING

Once the servo motor is approximately tuned (by using the default PID gains), the servo loop can be further tuned by observing the response while the machine is running. This can be done by observing the positive and negative peak position error using the set-up program (see section 4.6.2 – Windows Setup Program Reference or 5.3 – DOS Setup Program Reference).

The PID gains are generally adjusted to achieve the minimum peak errors.

Note: Higher gains, which are used to minimize the error, also require more motor current. This will cause additional heating in the motor. Therefore, use the lowest possible gains to achieve acceptable running error.

In addition, the "Acquire Data Signatures" selection can be used to acquire the "current", "error", "actual profile", and "reference profile" for one stroke while the machine is running. This data is sampled every millisecond and saved to a text file. This file can be uploaded into an Excel worksheet and viewed in a chart as well as scaled and summarized. This allows the corresponding waveforms to be observed and analyzed.

SECTION 3
TUNING THE SERVO LOOP

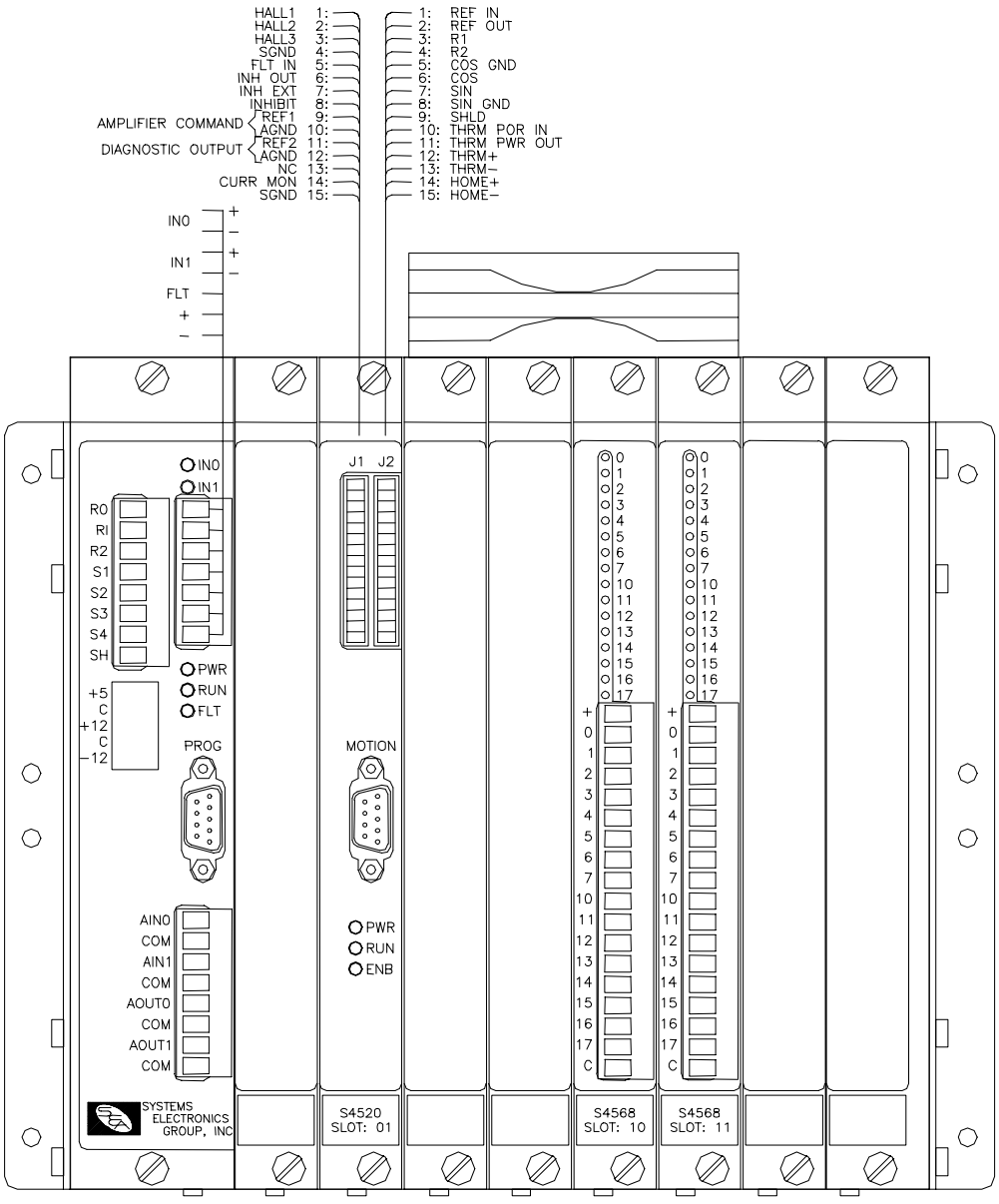
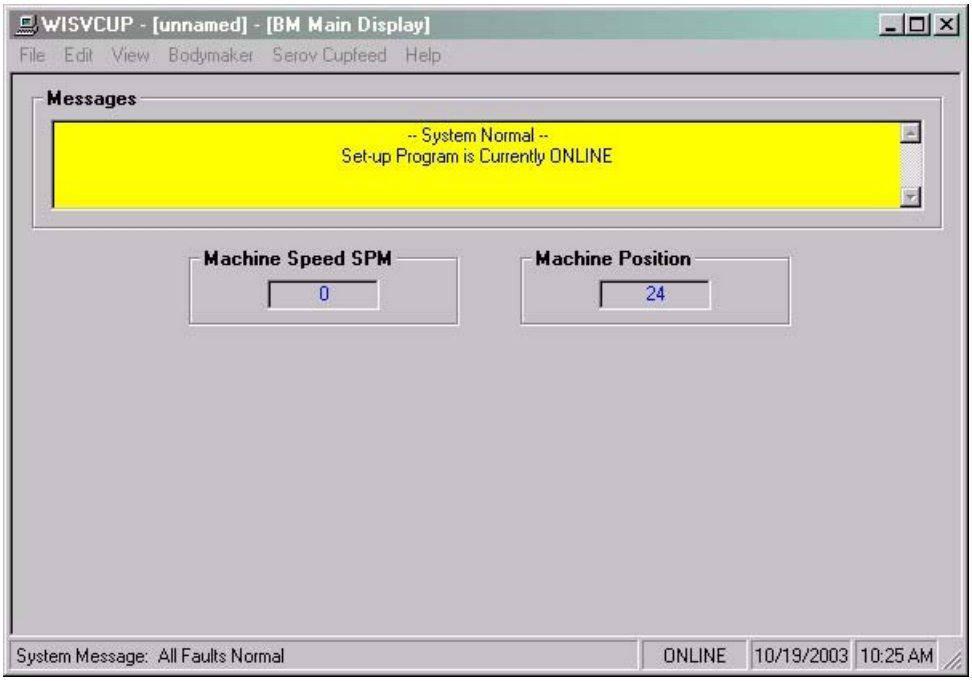


Figure 6 - S4520 Motion Controller Pin-outs

SECTION 4
WISVCUP - WINDOWS BASED SET-UP PROGRAM REFERENCE

The Windows based set-up program is menu driven, allowing the user to easily view data, alter set-up variables or set machine timing (machine offset, timing signal locations, etc.), using a PC running the Windows (95/98/ME/2000/XP/NT) operating system. The set-up variables are used to configure and tune the M4510 to match the configuration and performance of the specific bodymaker (see section 2.9 – HSL-WISVCUP Set-Up).

Note: The set-up program is an on-line communications program used to interface with the M4510 module. The data displayed and set in the windows is communicated directly to the module, while in the "Online" edit mode. Therefore, prior to going online with the processor, make sure an RS-232 cable is connected from the COM port on the computer to the "PROG" or "MOTION" port on the M4510. The variables displayed while in the "Online" edit mode are read directly from the processor. Data is saved to a "Set-up Data" file (*.sdt) whenever changes are made to a parameter or if the data is uploaded from the processor.



SECTION 4
WISVCUP - WINDOWS BASED
SET-UP PROGRAM REFERENCE

4.1 GENERAL DESCRIPTION

Title Bar: At the top of the window is the "Title Bar". The title bar is used to display the name of the working "Set-up Data" file, as well as, the name of the active "Window". The title bar is dark if the window is active and grayed if another window is active. The color depends on the settings of the Display Properties of the Control Panel.

Status Bar: At the bottom of the window is the "Status Bar". The status bar is used to display system messages, online or offline mode, as well as, the current time and date as set by the operating system. The system messages panel displays general information about operation of the system. The Online/Offline mode panel displays the status of the current set-up program mode of operation. The mode of operation can be changed by simply double clicking the online/offline mode panel.

Hot Keys: Hot keys are activated by holding down the "ALT" key and simultaneously pressing the underlined letter of the desired function. Almost every function can be activated by either pressing a series of hot keys or using the "TAB" key to move between fields.

Online/Offline Modes: The set-up program allows the user to make changes while "Online" with the processor. The "Offline" mode is used to preset parameters prior to download. All functions are available to the user while "Online", however, specific "Online" functions are disabled in the "Offline" edit mode.

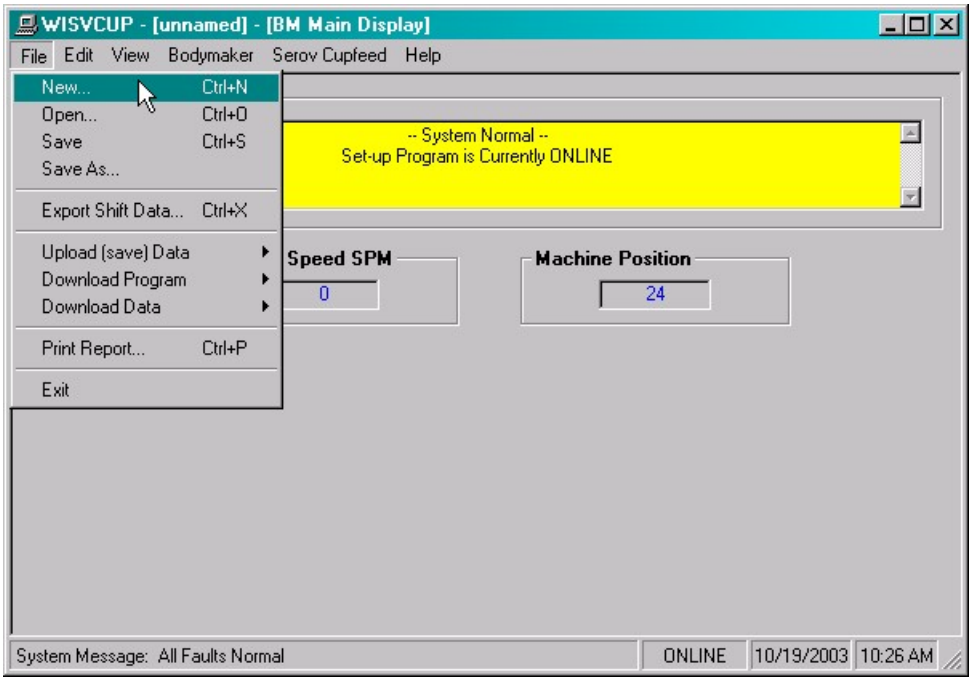
Note: Offline changes can only be made by enabling "Offline Editing", accessed under the "Edit" menu.

Getting Help: The entire contents of the user's manual is contained within the help file. Pressing Ctrl+H will display the help file window. Pressing the F1 key will display the contents file. Hot spots allow jumps to other topics to display additional information as desired. Selecting About WISVCUP from the Help menu will display a dialog box listing information about the current revision of the setup program and how to obtain technical support.

4.2 THE FILE MENU

The "File" menu allows the user to perform the following functions:

- Create a "New" set-up "Data File".
- Open an existing "Data File".
- Save any changes made to the current "Data File" to disk.
- Upload (save) Data from the Processor.
- Download a SYSdev (.sdv) program to the processor
- Download (restore) Data from the current set-up "Data File" to the processor.
- Print a Report of the current set-up parameters.
- Exit the set-up program.



4.2.1 THE SET-UP DATA FILE

The set-up "Data File" (.sdt) is a binary access file, designed for fast file I/O operation. When the set-up program is first invoked, the default set-up parameters are loaded into memory. If changes are made to any of the set-up parameters (either online or offline), as well as shift data, the user will be flagged to "Save Changes" upon exit of the program.

Note: Any windows based "Set-up" program can open a set-up "Data File", however, the data tables will not be properly aligned. The user will be alerted to the problem if a set-up data file has been created by either a different set-up program or a different revision of the software.

The set-up "Data File" is similar to that of a word processing file. When the program first starts, a default file is loaded and the user is able to make any changes as desired. The set-up program is unaware of the settings and parameters that exist within the processor. Therefore, to normalize the set-up program, the user should define or open an existing file, then upload "All" variables from the processor. This allows the user to either create a backup of the data or maintain an existing file. The user can even open a data file for another bodymaker, save the file to a new name, make the necessary changes and simply download the new parameters to another processor.

The following functions can be accessed any time, from any set-up or display windows.

New: To create a "New" data file, select "New" from the "File" menu or press "Ctrl + N". This creates a completely new file, loaded with the default variables and the word "[unnamed]" is displayed in the title bar. If any changes were made to the existing file, the user is prompted to save changes to the existing file.

Open: To "Open" and existing data file, select "Open" from the "File" menu or press "Ctrl + O". This displays a dialog box allowing the user to select an existing data file to open. The name of the file will be displayed in the title bar. If any changes were made to the existing file, the user will be prompted to save any changes before terminating the program.

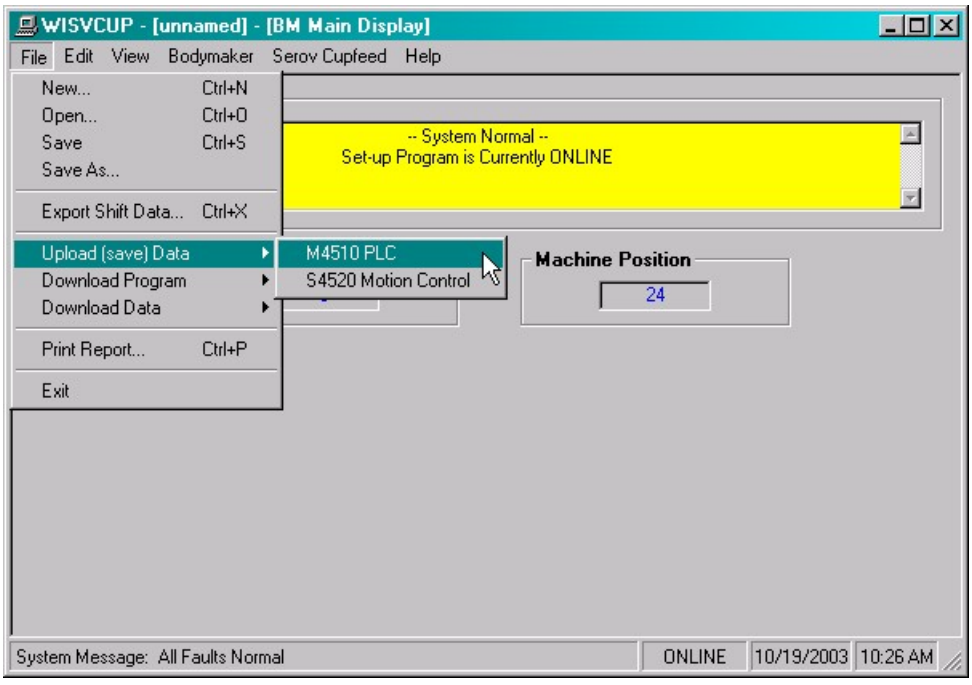
Save: To "Save" data file to disk, select "Save" from the "File" menu or press "Ctrl + S". This displays a dialog box allowing the user to select a folder and enter a name for the file. The user will be notified if the file already exists and the extension ".sdt" will automatically be added to the file name. If this is a "New" file, the user will be prompted to enter a file name.

Save As: To save the data file to a new name, select "Save As" from the "File" menu.. This displays a dialog box allowing the user to select a folder and enter in a new name for the file. The user will be notified if the file exists and the extension ".sdt" will automatically be added to the file name.

Export Shift Data…: This function allows the user to export the shift data to a "Tab Delimited" text file. This allows the user to easily use the shift data to produce production reports.

4.2.2 UPLOAD (SAVE) DATA

The "Set-up" program allows the user to upload blow-off parameters, timing channel set-points and shift data from the M4510 and S4520 into a set-up "Data File". This function is accessed from the "File" menu and the user is given the choice of the following options:

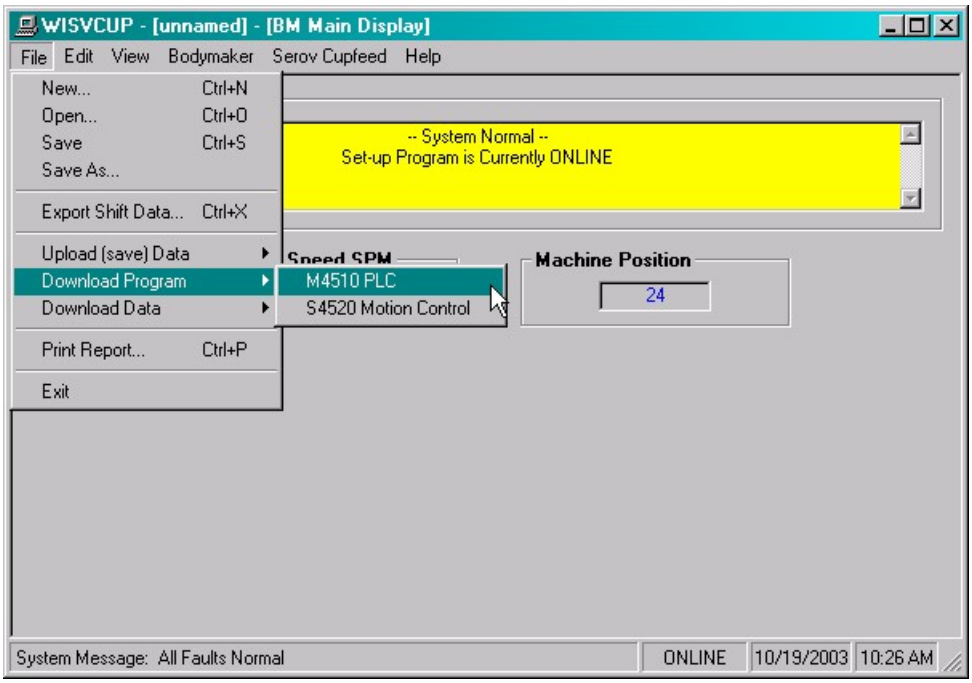


M4510 PLC: This option uploads (reads) set-up parameters, machine timing set-points and shift data from the M4510, only.

S4520 Motion Control: This option uploads (reads) set-up and tuning parameters from the S4520 Motion Control Board, only.

4.2.3 DOWNLOAD PROGRAM

The "Set-up" program allows the user to "Download" any SYSdev program file to either the M4510 or S4520.



Note: To "Download" a SYSdev program to the processor, the program must be "Online". If "Online" mode cannot be achieved, program download will not be executed. If the program is currently "Offline", the user will be prompted to first go "Online".

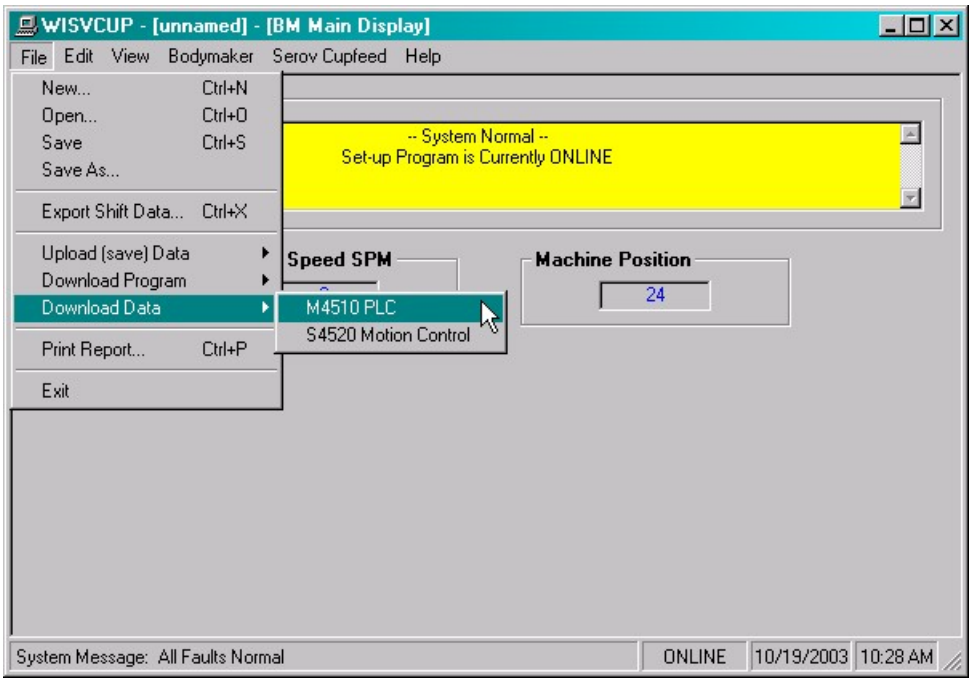
Once selected, and the set-up program "Online" with the processor, a dialog box will be displayed, allowing the user to select the SYSdev file to download.

Note: Only the files with the ".sdv" file extension will be displayed. It is important to keep in mind that only a valid M4510 PLC SYSdev file can be downloaded through the set-up program. Care should be taken when selecting a program to download.

Once selected, a message box is displayed informing the user of the current program, revision and checksum of the program loaded in the processor, as well as, that of the selected program. The user must confirm their selection by clicking the "Yes" command button. After the user confirms their choice, program download is initiated and the current program download address is displayed. When program download is complete, the user is prompted to acknowledge. Control is passed back to the main program and the set-up program remains in an "Online" edit mode.

4.2.4 DOWNLOAD (RESTORE) DATA

The set-up program allows the user to download "Set-up" parameters, timing channel set-points and shift data to the M4510 or S4520 from the set-up "Data File". This function is accessed from the "File" menu and the user is given the choice of the following options:



M4510 PLC: This option downloads set-up parameters, machine timing set-points and shift data to the M4510, only.

S4520 Motion Control: This option downloads set-up and tuning parameters to the S4520 Motion Control Board, only

Note: Only the values contained within the current data file are used. If the validity of the current data file is questionable, review the data in an "Offline" mode prior to download.

4.2.5 PRINT REPORT

The "Set-up" program allows the user to generate a "Report" printout of all the set-up parameters, timing channel set-points and shift data. This function is accessed from the "File" menu.

At the top of each page, the report displays the name of the set-up file being printed. At the bottom of each page is the date and time the document was printed, as well as, the page number.

To printout a report of the settings contained in the set-up "Data File", perform the following:

1) From the "File" menu, select "Print Report" or press "Ctrl + P".

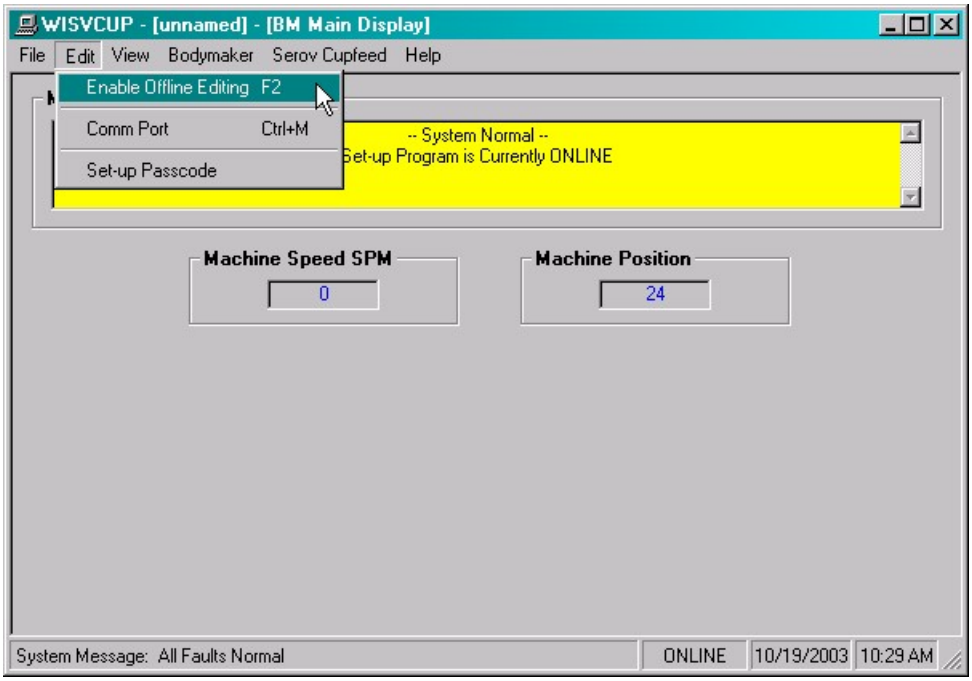
2) This displays the "Print Setup" dialog box, allowing the user to select a printer, as well as, the paper size and orientation. Once the user selects "OK", the report is generated and sent to the specified printer device.

Note: This function makes use of the windows print manager, which allows the user to continue with their work while the document is being printed.

4.3 THE EDIT MENU

The "Edit" menu allows the user to perform the following functions:

- Enable/Disable Offline Editing.
- Set-up the Comm Port.
- Edit the Set-Up Passcode.



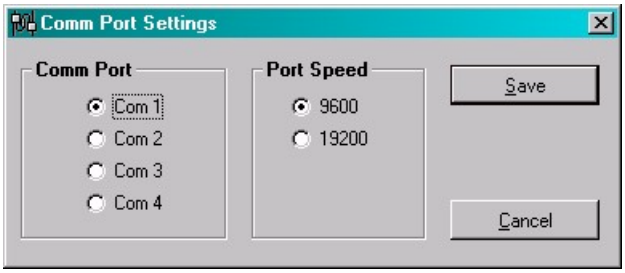
4.3.1 ENABLE OFFLINE EDITING

This function allows the user to perform "Offline" editing on the currently loaded set-up data file. This allows the user the ability to make any necessary changes to the set-up parameters while offline with the processor.

If offline editing is not enabled, the user is only able to view the set-up parameters and shift data. When the program is first invoked, the default setting is offline editing disabled. The user will need to specifically select "Enable Offline Editing" from the edit menu (or press function key F2) to enable/disable this feature.

4.3.2 SET-UP COMM PORT

This function allows the user to specify the serial communications port and rate to communicate with the M4510. The PROG and MOTION communicates at 9600 baud.



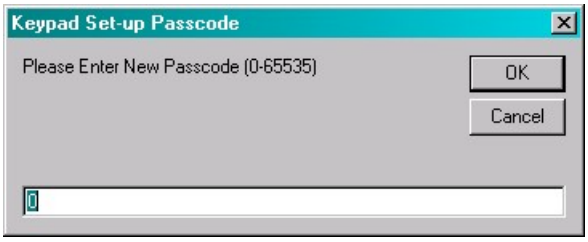
The option to select the 19200 baud rate is to allow the user to communicate via the S4516 serial communications board. In most cases, the user will only need to specify the communications port and leave the baud rate at 9600.

If communication problems occur, make sure there is a secure connection from the PC to the PLC. Then check the Comm port. In most cases, the user will only need to select a new Comm port. If communication problems persist, there may be another program causing a conflict with the port. Check the port configuration from the "Settings" folder.

4.3.3 EDIT SET-UP PASSCODE

The edit "Set-up Passcode" is an "Online" function only. This allows the user the ability to directly change the value of the "Set-up Passcode".

Once selected, an input box is displayed, allowing the user to view the current "Passcode" setting and to change the value if necessary.



If the passcode is set to zero, passcode entry is disabled. The operator can press the Set-up key on the Keypad/Display and simply press the <ENTER> key to gain access to the set-up parameters without having to enter a zero.

If the value of the "Passcode" is set somewhere between 1 and 65,000, "Passcode Entry" is enabled. This requires the operator to enter in the "Correct" passcode to gain access to the set-up parameters.

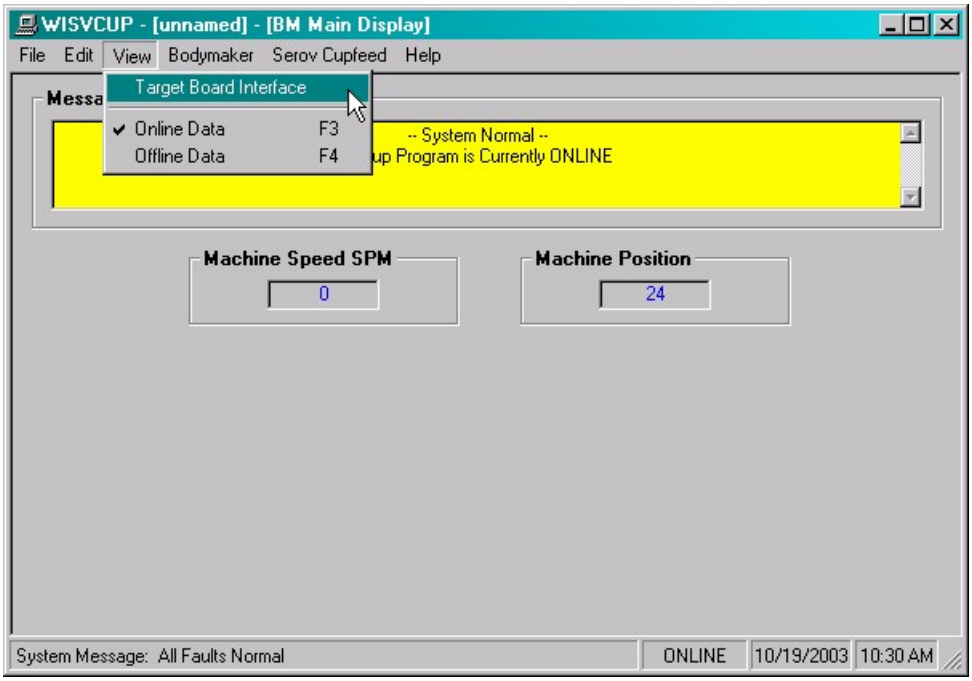
Note: Passcode entry is only in effect when the "Set-up Enable" selector switch is in the "Disable" position.

If an invalid value is entered, the passcode value will not be reset and a message box notifying the user of the error is displayed.

4.4 THE VIEW MENU

The "View" menu allows the user to perform the following functions:

- View the "Target Board Interface"
- View "Online" Data
- View "Offline" Data

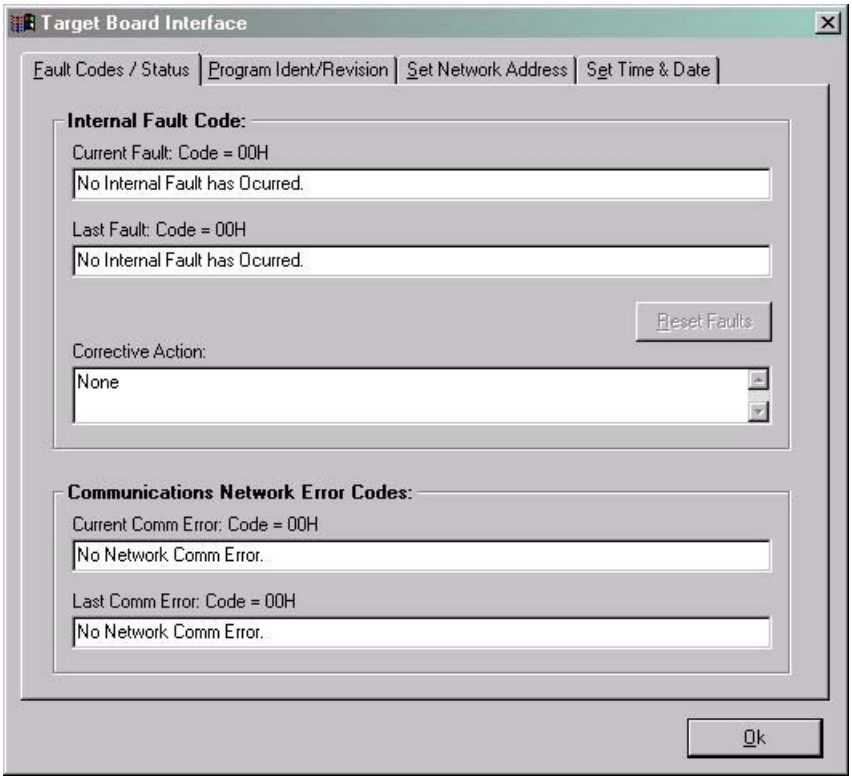


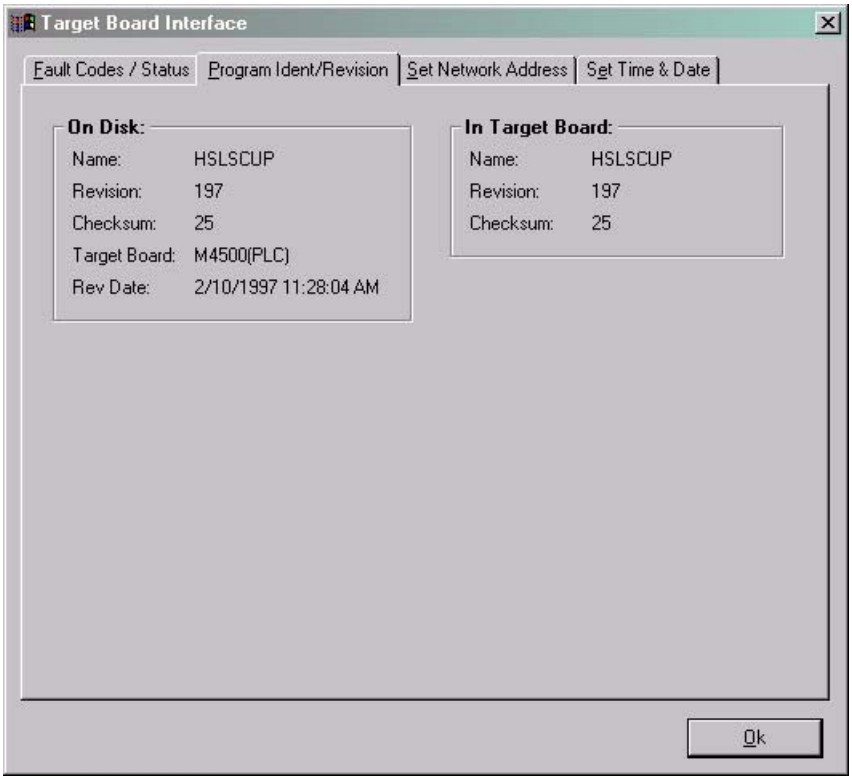
4.4.1 TARGET BOARD INTERFACE

This function allows the user to view fault codes, S3000 network communication error codes and review the current "Ident" and "Revision" of the application program. This is accessed by the "View" menu, by selecting "Target Board Interface".

Once invoked, the set-up program will prompt the user to select a program. The setup program will then attempt to communicate with the M4510. If unsuccessful, a warning message will be displayed, prompting the user to either "Retry" or "Cancel" the operation. The "Target Board Interface" window will then be displayed.

SECTION 4
WISVCUP - WINDOWS BASED
SET-UP PROGRAM REFERENCE





4.4.2 VIEW ONLINE DATA

This function allows the user to go "Online" with either the M4510 or S4520. This is accessed by the "View" menu, by selecting "Online Data" or by simply pressing the "F3" function key.

Note: The user can be toggled between "Offline" and "Online" by simply double clicking on the "Online" or "Offline" panel displayed in the status bar at the bottom of the window.

Once invoked, the set-up program will to open the Comm port and attempt to communicate with the processor. If unsuccessful, a warning message will be displayed prompting the user to either "Retry" or "Cancel" the operation. If the operation is canceled and communication with the processor cannot be established the system will be placed in an "Offline" mode.

Note: Anytime while the set-up program is "Online" with the processor and communication is interrupted, a warning message will be displayed.

4.4.3 VIEW OFFLINE DATA

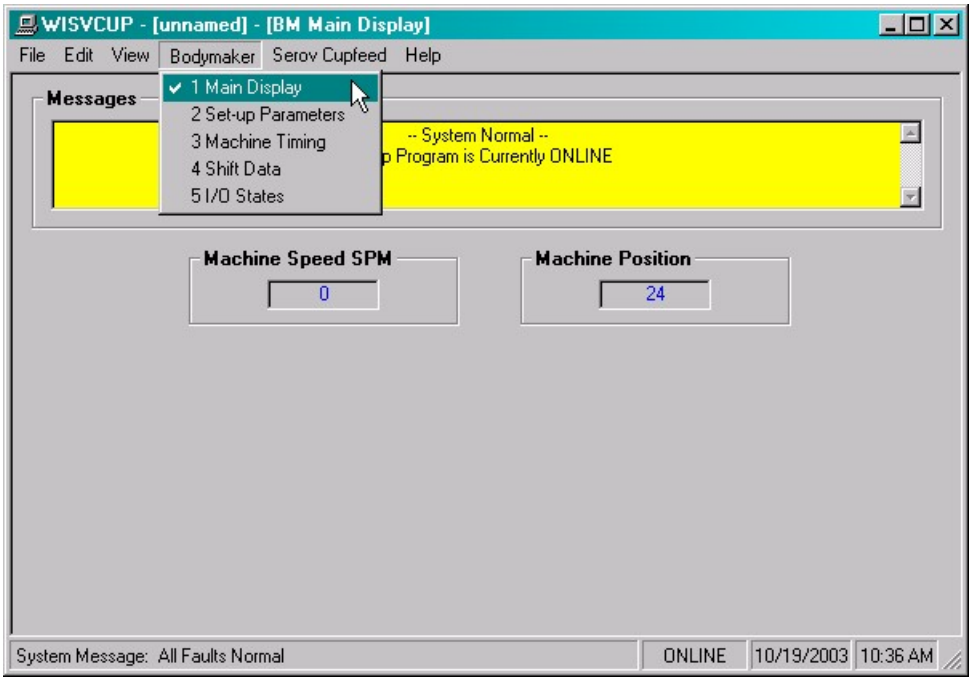
This function allows the user to place the set-up program in an "Offline" mode. This is accessed by the "View" menu, by selecting "Offline Data" or by simply pressing the "F4" function key. All values displayed in "Offline" edit mode reflect the actual values contained in the currently loaded set-up data file.

Note: The program can be toggled between "Online" and "Offline" by simply double clicking on the "Online" or "Offline" panel displayed in the status bar at the bottom of the window.

Once invoked, the set-up program will cease communication with the processor and close the Comm port.

4.5 THE BODYMAKER MENU

The "Bodymaker" menu allows the user to select one of five different Display/Set-up windows, used to modify set-up parameters, view shift data, adjust timing channel set-points or receive feedback about the current status of the control system

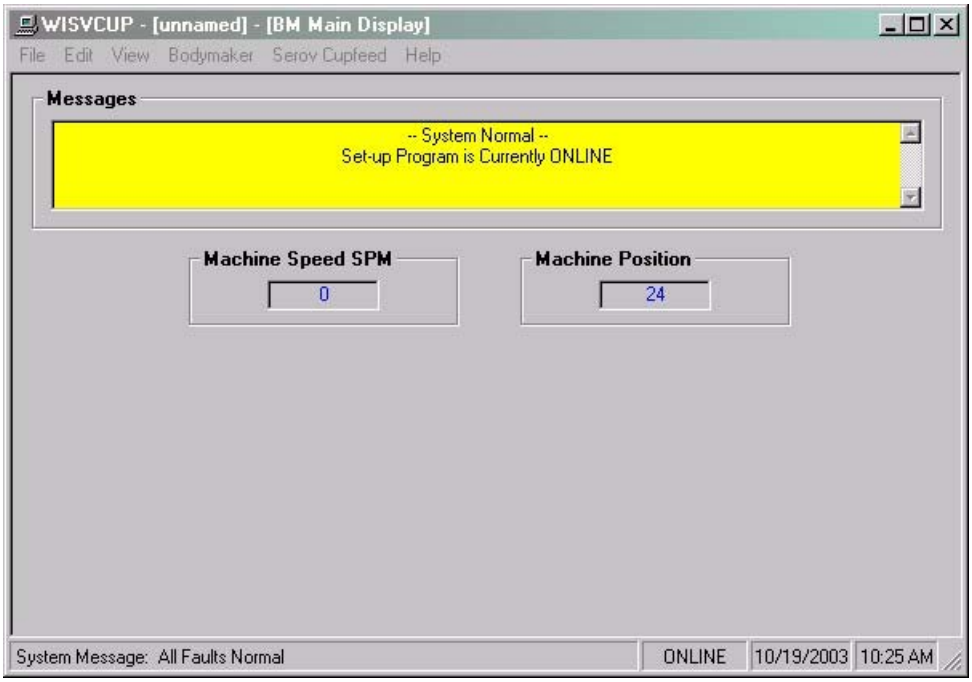


Once a window menu item is selected, a check mark is placed next to the selected item, and the selected window is displayed and the name is changed in the title bar.

Note: "Read" only variables are displayed in blue with a gray background. Any variables that can be altered by the user are displayed in black with a white background. In most cases, a parameter that can be changed by the user will have associated with it increment and decrement controls. The user can either click on the desired parameter to adjust and enter in a new value, or use the increment or decrement controls to change the value by 1 unit.

4.5.1 THE BODYMAKER MAIN DISPLAY WINDOW

The bodymaker "Main Display" window is used to display the general state of the control system. This window is selected from the "Bodymaker" menu.



The following is a list of the functions of the "Main Display" window.

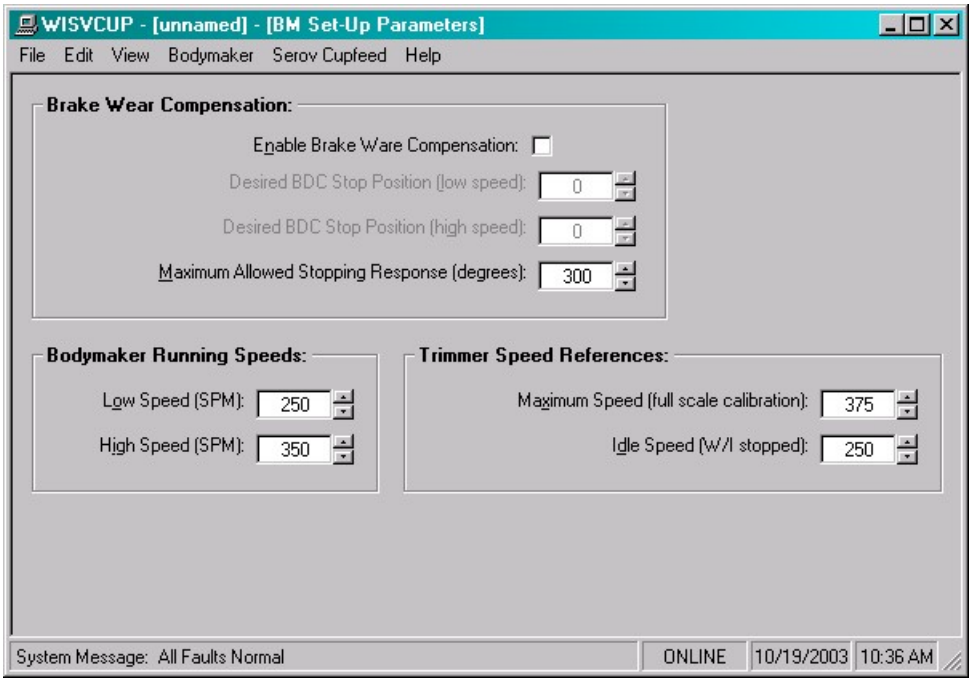
Messages: The "Messages" display is continuously updated. It displays alarm and status messages specific to the M4510, as well as, the current "Online" or "Offline" status of the set-up program. By simply scrolling the display the user is able to view all active alarm and status messages. If no alarm or status messages are active, a default message is displayed.

Machine Speed SPM: This display is only active while "Online" and displays the current speed of the machine in "Strokes Per Minute".

Machine Position: This display is only active while "Online" and displays the current position to the main crank resolver in degrees.

4.5.2 THE BODYMAKER SET-UP PARAMETERS WINDOW

The bodymaker "Set-up Parameters" window is used to view and adjust the set-up parameters. This window is selected from the "Bodymaker" menu.


WISVCUP - [unnamed] - [BM Set-Up Parameters]
File Edit View Bodymaker Serov Cupfeed Help
Brake Wear Compensation:
Enable Brake Ware Compensation:
Desired BDC Stop Position (low speed): 0
Desired BDC Stop Position (high speed): 0
Maximum Allowed Stopping Response (degrees): 300
Bodymaker Running Speeds:
Low Speed (SPM): 250
High Speed (SPM): 350
Trimmer Speed References:
Maximum Speed (full scale calibration): 375
Idle Speed (W/I stopped): 250
System Message: All Faults Normal
ONLINE
10/19/2003
10:36 AM

Brake Wear Compensation:

1) **Brake Wear Compensation Enable:** This is used to enable or disable the brake wear compensation. To disabled, click the checkbox and remove the checked state. If the compensation is to be enabled, click the checkbox to set the checked state.

2) **Desired BDC Stop Position (Low Speed):** This is the desired stopping location (in degrees) for a BDC stop at low speed when the brake wear compensation is enabled. This is typically set to 000 degrees (back dead center).

   Note: This parameter is automatically disabled whenever "Brake Wear Compensation" is disabled.

3) **Desired BDC Stop Position (Low Speed):** This is the desired stopping location (in degrees) for a BDC stop at high speed when the brake wear compensation is enabled. This is typically set to 000 degrees (back dead center).

   Note: This parameter is automatically disabled whenever "Brake Wear Compensation" is disabled.

4) **Maximum Allowed Stopping Response:** This defines the maximum allowed brake response before the "Brake Response Too Long" alarm is generated. If the actual brake response (number of degrees from when the brake is activated to the position where the press ends up at rest when a BDC stop is performed) is longer than this number, the alarm is generated. If the actual brake response is less, the alarm is not generated. Set this parameter to the value where the brake response is considered too long and service to the brake should be performed (typically 270 to 300 degrees).

Bodymaker Running Speeds:

1) **Running Bodymaker Low Speed (SPM):** This is the speed (in strokes per minute) the bodymaker will run when in low (inch) speed.

2) **Running Bodymaker High Speed (SPM):** This is the speed (in strokes per minute) the bodymaker will run when in high (cont./single) speed.

Trimmer Speed References:

1) **Trimmer Maximum Speed (CPM):** The "Trimmer Maximum Speed" is used to scale the 0-10VDC analog output such that when the bodymaker is running at the speed entered the analog output is 10 volts. This is typically set to the running high speed of the Bodymaker or slightly higher.

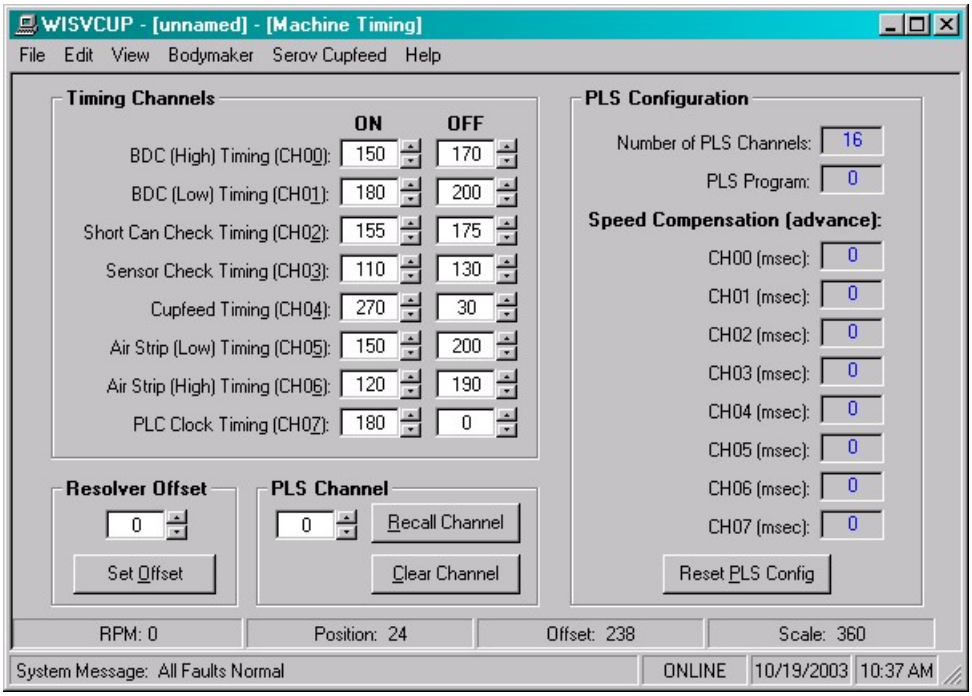
2) **Trimmer Idle Speed (CPM):** This parameter determines the speed the trimmer will run at when the bodymaker is stopped (de-clutched).

   Note: This parameter is used to provide the speed reference when the bodymaker speed is zero. When the bodymaker is running, the trimmer speed reference is proportional to the speed of the bodymaker.

4.5.3 THE MACHINE TIMING WINDOW

The Machine Timing window is used to invoke the PLS programming command menus. From this window, the user can view or adjust the following parameters:

- Adjust Timing Channel set-points.
- Set the Main Crank resolver offset.
- Clear or Recall a PLS timing channel.
- View the current PLS configuration
- Reset the PLS configuration to default settings.



The following parameters are displayed at the bottom of this window:

RPM: This is the current speed in "Revolutions per Minute" of the main crank resolver.

Position: This is the current "Position" in degrees of the main crank resolver.

Offset: This is the current resolver offset (set in degrees).

Scale: This is the scale factor of the resolver or the number of divisions in one revolution.

Zeroing the Machine (setting the resolver offset): To set machine zero, perform the following:

1) Connect an RS-232 SYSdev cable from the COM port on the computer to the "PROG" port on the M4510.

2) From the "Bodymaker" menu, select "Machine Timing".

3) From the "View" menu, select "Online Data".

4) Observe the "Position" field at the bottom of the window. Verify that as the machine is rotated forward, that the position increases linearly from 0 through 359 degrees. If not, swap the S1 and S3 leads at the resolver connector on the M4510. Then, verify that the position does indeed increase with forward movement.

5) Position the machine at back dead center.

6) Auto zero the resolver by entering "0" in the "Resolver Offset" field and clicking the "Set Offset" command button. A message box will appear, prompting the user to confirm their choice. Select "Yes" to set the resolver offset.

7) The M4510 will calculate the actual offset value required to make this the "0" position. The new offset value will be displayed in the "Offset" field and the position will then read zero.

Adjusting the Timing Channel Setpoints: To set any of the timing signal setpoints, perform the following:

Note: Any changes made to the timing channel setpoints will be saved as part of the setup data file.

1) Connect an RS-232 SYSdev cable from the COM port on the computer to the "PROG" port on the M4510.

2) From the "Bodymaker" menu, select "Machine Timing".

3) From the "View" menu, select "Online Data".

4) Setpoints for a particular channel are either entered in the field or adjusted by using the increment/decrement controls.

   Note: Only one set-point per channel is used.

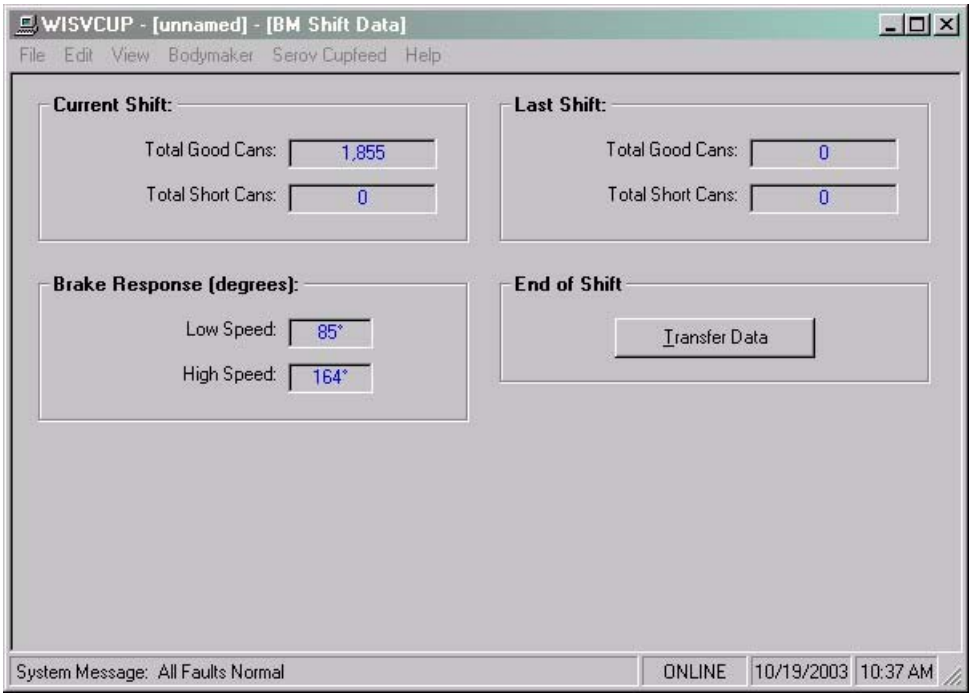
5) If a channel needs to be "Recalled" or "Cleared", enter the desired channel number into the "PLS Channel" field. Click the "Recall Channel" command button to recall the set-point. Click the "Clear Channel" command button the completely clear the selected channel.

   Note: If a channel has been cleared or the "On" and "Off" setpoints have the same setting, the set-point will be displayed as "*****".

Resetting the PLS Configuration: As an aid to the user, the current PLS configuration is displayed as part of this window. The PLS configuration should only need to be reset if a new module has been installed. To reset the PLS configuration, click the "Reset PLS Config" command button. This function only resets the PLS configuration to the default settings for the bodymaker.

4.5.4 THE SHIFT DATA WINDOW

This window is used to view the Current Shift data, Last Shift data, Low and High speed brake responses and to invoke the "End of Shift" data transfer.



Current Shift - Total Good Cans: This is the total number of good cans produced so far into the current shift. This is essentially a can counter.

Current Shift - Total Short Can Faults: This is the total number of short can faults that have occurred so far into the current shift.

Last Shift - Total Good Cans: This is the total number of good cans produced in the last (previous) shift. This is essentially a can counter.

Last Shift - Total Short Can Faults: This is the total number of short can faults that occurred in the last (previous) shift.

Note: The current shift data is transferred to the "Last shift" data when the end of shift input transfers from a "0" to a "1". This can be at the end of either an 8 or 12-hour shift. This data can also be reset from this menu by clicking the “Transfer Data” command button.

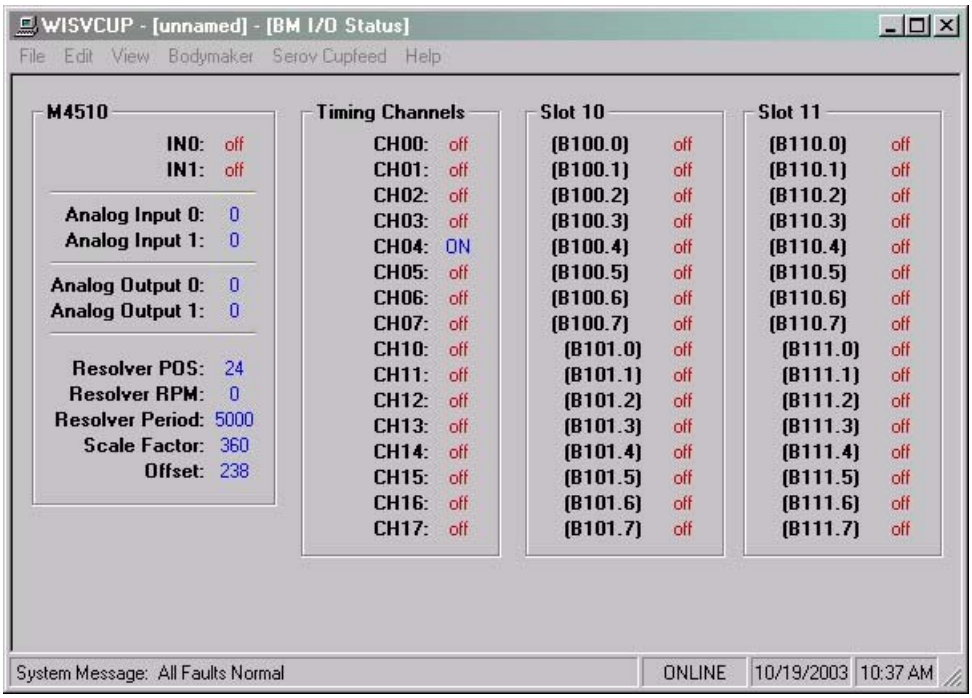
Lo Speed Brake Response (degrees): This is the number of degrees from the when the clutch was de-activated (at the BDC (Lo) timing) to where the bodymaker crankshaft came to rest when a BDC stop was performed at Low speed. This can be used to determine the general condition of the brake and whether servicing of the brake is required.

Hi Speed Brake Response (degrees): This is the number of degrees from the when the clutch was de-activated (at the BDC (hi) timing) to where the bodymaker crankshaft came to rest when a BDC stop was performed at high speed. This can be used to determine the general condition of the brake and whether servicing of the brake is required.

Note: The brake response for both high and low speeds is updated after each BDC stop.

4.5.5 THE I/O STATES WINDOW

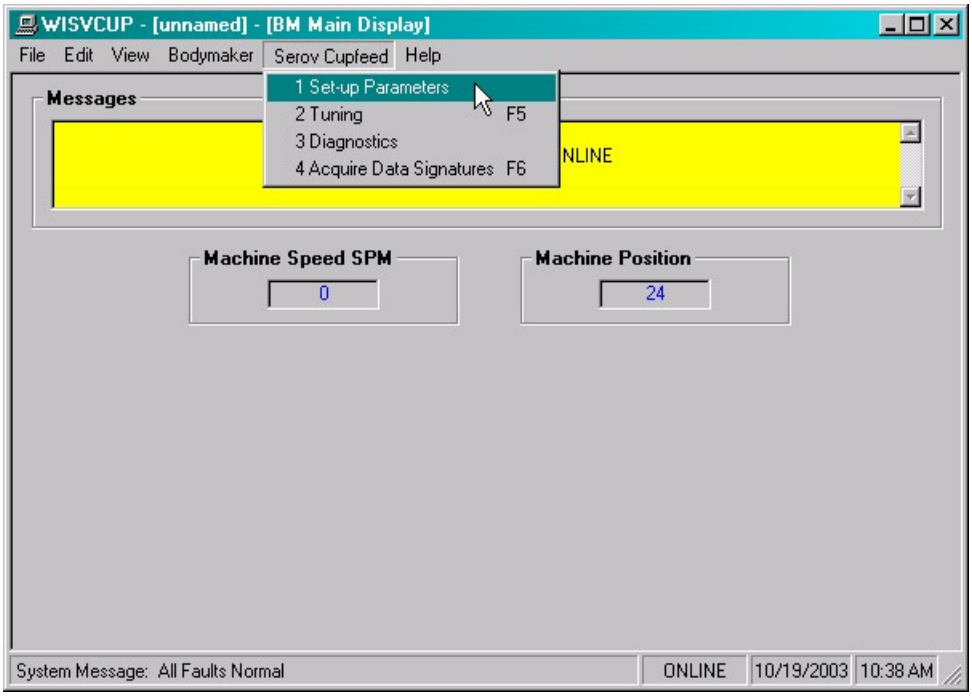
The "I/O States" window is provided to display states of the inputs and outputs. The control boards, the states of the timing channels, as well as states of the M4510 are shown. This includes the interrupt inputs (IN0 and IN1), the analog I/O and the resolver. These values are displayed as read by the M4510 processor.



4.6 THE SERVO CUPFEED MENU

The "Servo Cupfeed" menu allows the user to select one of four different Display/Set-up windows, used to modify set-up parameters and tune the servo cupfeed motor.

Prior to making this selection, make sure an RS-232 SYSdev cable is connected from the COM port on the computer to the MOTION port on the S4520 motion control board.

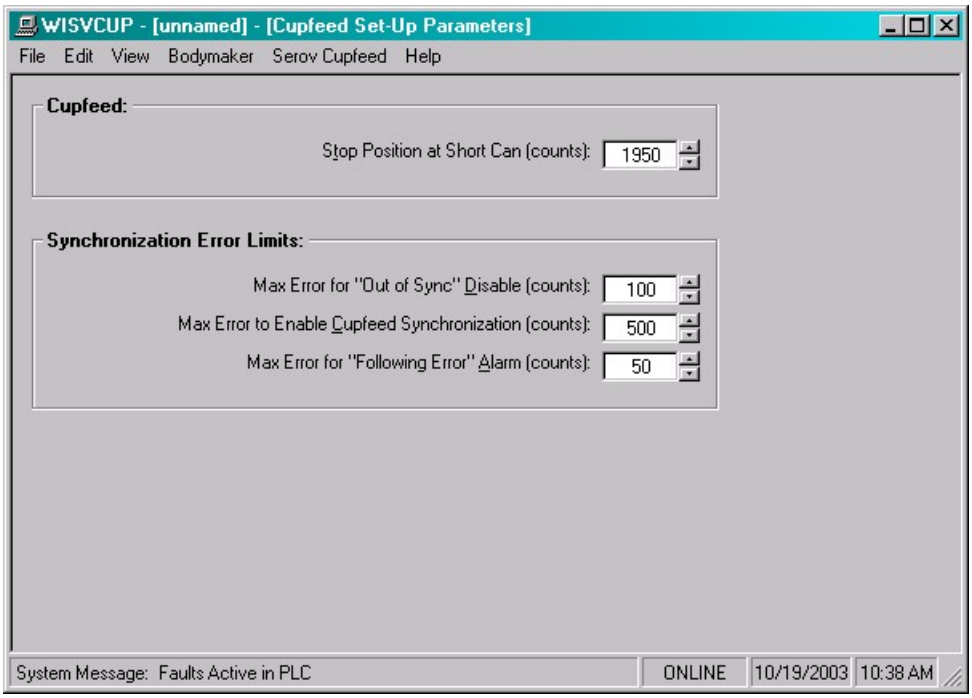


Once a window menu item is selected, the selected window is displayed and the name is changed in the title bar.

Note: In general, "Read" only variables are displayed in blue with a gray background. Any variables that can be altered by the user are displayed in black with a white background. In most cases, a parameter that can be changed will have an associated increment and decrement control. The user can either click on the desired parameter and enter in a new value, or use the increment or decrement control to change the value by one unit.

4.6.1 THE CUPFEED SET-UP PARAMETERS WINDOW

This selection is used to set the cupfeed set-up parameters. When selected, the servo cupfeed “Set-up Parameters" window is invoked.


WISVCUP - [unnamed] - [Cupfeed Set-Up Parameters]
File Edit View Bodymaker Serov Cupfeed Help
Cupfeed:
Stop Position at Short Can (counts): 1950
Synchronization Error Limits:
Max Error for "Out of Sync" Disable (counts): 100
Max Error to Enable Cupfeed Synchronization (counts): 500
Max Error for "Following Error" Alarm (counts): 50
System Message: Faults Active in PLC
ONLINE
10/19/2003
10:38 AM

The servo cupfeed “Set-up Parameters" window contains the following selections:

Cupfeed Stop Position at Short Can (Counts): This is the position the cupfeed cam will stop at when a short can alarm occurs. This should be set to the trailing edge of the short can check timing signal such that when a short can is detected, the cupfeed cam will immediately stop (and not continue following the ram).

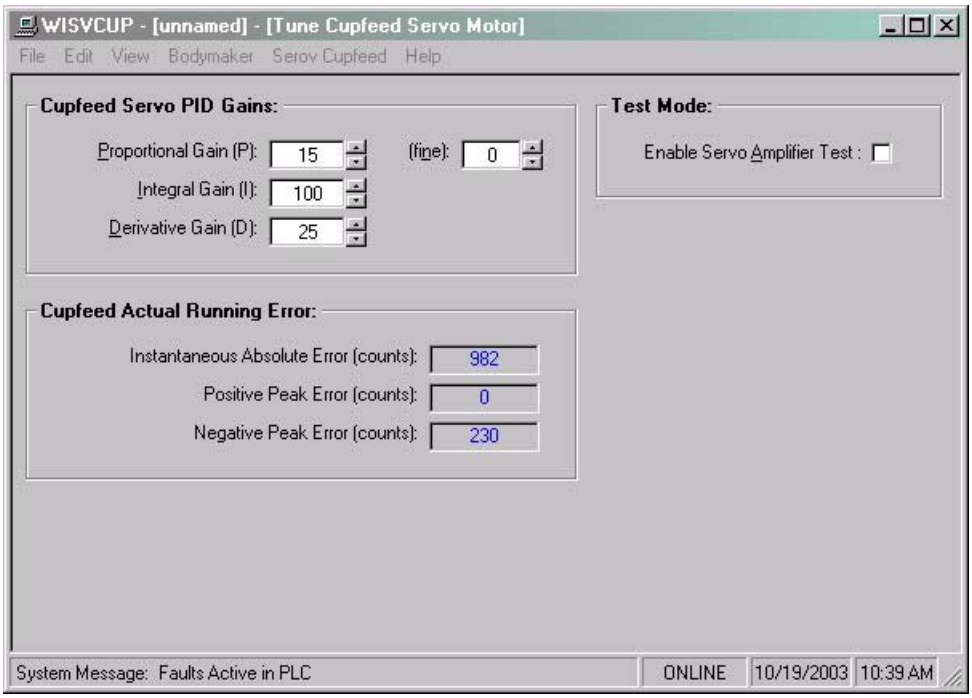
Max Error for "Out of Sync" Disable: This is the maximum amount of error allowed between the ram and the cupfeed to enable the cupfeed to open. If the running error is less than this threshold, the cupfeed is in sync with the ram and the cupfeed can be opened. If the running error is greater than this threshold, the cupfeed will be disabled.

Max Error to Enable Cupfeed Synchronization: This threshold is used to synchronize the cupfeed with the main crank when the clutch is activated. Once the main crank is within this error threshold of the cupfeed, the cupfeed will than sync in with the main crank and then track the ram using the PID servo loop.

Max Error for "Following Error" Alarm: This is the maximum amount of error allowed between the ram and the cupfeed before a "Following Error" fault is generated. This is enabled once the cupfeed is in sync with the main crank. The "Following Error" alarm is filtered to allow short errors in excess of this threshold to occur without generating the alarm. This threshold is primarily used to detect instability in the cupfeed servomotor or peak current limit conditions (excessive frictional loads in the cupfeed).

4.6.2 THE CUPFEED TUNING WINDOW

This selection is used to tune the servo cupfeed motor. When selected, the servo cupfeed “Tuning" window is invoked.


WISVCUP - [unnamed] - [Tune Cupfeed Servo Motor]
File Edit View Bodymaker Serov Cupfeed Help
Cupfeed Servo PID Gains:
Proportional Gain (P): 15
(fine): 0
Integral Gain (I): 100
Derivative Gain (D): 25
Test Mode:
Enable Servo Amplifier Test :
Cupfeed Actual Running Error:
Instantaneous Absolute Error (counts): 982
Positive Peak Error (counts): 0
Negative Peak Error (counts): 230
System Message: Faults Active in PLC
ONLINE
10/19/2003
10:39 AM

Cupfeed Servo PID Gains:

Proportional (P) Gain: The proportional gain is used to create an error term, which is "proportional" to the difference between the main crank position and servo motor position. For a specific amount of error, the higher the (P) gain, the higher the torque generated to null the error.

Note: By itself, the (P) term cannot null the error to zero since a torque is only generated when there is a difference between the main crank position and servomotor.

This (P) gain is used in conjunction with the other gains to define the system stability and responsiveness. A higher the (P) gain will cause the servo motor to be more responsive. Too high of a (P) gain will cause the motor to become unstable (oscillate) because the system cannot respond quickly enough. Excessive current will also be drawn which is undesirable. Too low of a gain will cause excessive following error to the point of instability depending on where the (I) gain is set. The (P) gain can also be used to overcome high frictional loads (higher (P) for higher friction).

Integral (I) Gain: The integral gain is used to create an error term, which is proportional to the cumulative difference (error) between the main crank position and servo motor position. Thus for a fixed amount of error, the torque generated due to the integral error term will continue to increase at a rate proportional to the (I) gain. The higher the integral error term, the faster the torque generated to null the error will increase. This term is used to null a fixed error to zero since a torque of whatever amplitude will be generated to null the error to zero.

Note: Without the other gains ((P) and (D)), the system would be unstable.

As with the (P) gain, a higher (I) gain will cause the servo motor to be more responsive.

Note: Too high of an (I) gain will cause the motor to be unstable (oscillate) because the system cannot respond quickly enough. Too low of an (I) gain will cause excessive following error since at low (I) gains, the (P) gain would than be mostly responsible to null the error. The system will not be unstable if the (I) gain is set to zero.

Derivative (D) Gain: The derivative (D) gain is used to create an error term, which is proportional to the rate of change of error between the main crank position and servo motor position. Thus for a fixed amount of error, the torque generated due to the derivative error term will be zero (rate of change is zero). This error term is only generated when the amount of error is changing. The higher the rate at which the error changes, the higher the derivative error term. This term is primarily used to stabilize the servo loop. It is used to reduce ringing in under-damped responses or to provide fundamental stability to loops that would otherwise be unstable.

There is a definite compromise between to much and not enough (D) gain. With too low, the system may be marginally to completely unstable. Excess ringing with a corresponding longer settling time to a step response will occur if the (D) gain is too low. If the (D) gain is too high, system response will be reduced and high frequency oscillations may occur. This will not cause instability but higher current will be drawn and excessive high frequency torque will be applied to the load.

Cupfeed Actual Running Error:

Instantaneous Absolute Error (Counts): This is the instantaneous absolute (magnitude) difference between the main crank position and the cupfeed cam position.

Positive Peak Error (Counts): This is the maximum positive peak error detected as the cupfeed cam rotates. This is updated once every 1.5 seconds while the machine is running.

Negative Peak Error (Counts): This is the maximum negative peak error detected as the cupfeed cam rotates. This is update once every 1.5 seconds while the machine is running.

The above diagnostic error data can be used to judge how well the cupfeed cam motor is tuned and how well the cupfeed cam is tracking the main crank.

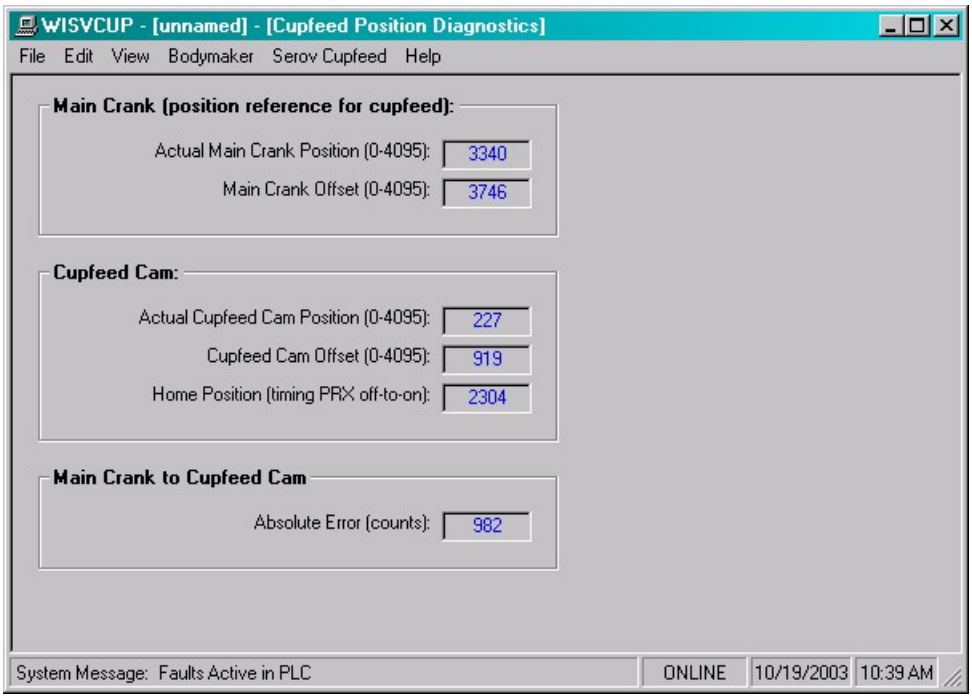
Servo Amplifier Test Mode:
When selected, the user is prompted to confirm their choice to enable servo amplifier test mode. If enabled, the servo amplifier test outlined in the trouble-shooting section (section 7.3 – Cupfeed Cam Does Not Move) can be performed.

Note: This is only used to verify the servo amplifier and motor. The machine cannot be run with the test mode enabled. For this reason due caution must be used when performing this test.

WARNING!! IN THE TEST MODE, THE SERVOMOTOR IS EXCLUSIVELY CONTROLLED WITH THE "TEST/OFFSET" (POT 4) ON THE B25A20. STAY CLEAR OF THE CUPFEED CAM AT ALL TIMES WHEN IN THE SERVO AMPLIFIER TEST MODE!!

4.6.3 THE CUPFEED DIAGNOSTICS WINDOW

This window displays both the main crank position (0 to 4095) and cupfeed servo motor position (0 to 4095). This is useful for trouble-shooting purposes to observe the resolver feedback is correct for both (correct direction and linear).


WISVCUP - [unnamed] - [Cupfeed Position Diagnostics]
File Edit View Bodymaker Serov Cupfeed Help
Main Crank (position reference for cupfeed):
Actual Main Crank Position (0-4095): 3340
Main Crank Offset (0-4095): 3746
Cupfeed Cam:
Actual Cupfeed Cam Position (0-4095): 227
Cupfeed Cam Offset (0-4095): 919
Home Position (timing PRX off-to-on): 2304
Main Crank to Cupfeed Cam
Absolute Error (counts): 982
System Message: Faults Active in PLC
ONLINE
10/19/2003
10:39 AM

This window contains the following selections:

Actual Main Crank Position (0-4095): This is the current main crank position with reference to a scale factor of 4096 for one complete revolution of the main crank. This is used as the primary reference for the cupfeed PID servo loop.

Main Crank Offset: This is set automatically when the main crank position is zeroed.

Actual Cupfeed Cam Position (0-4095): This is the current cupfeed cam position with a scale factor of 4096 for one complete revolution of the cupfeed cam. This is used as the feedback to the cupfeed PID servo loop.

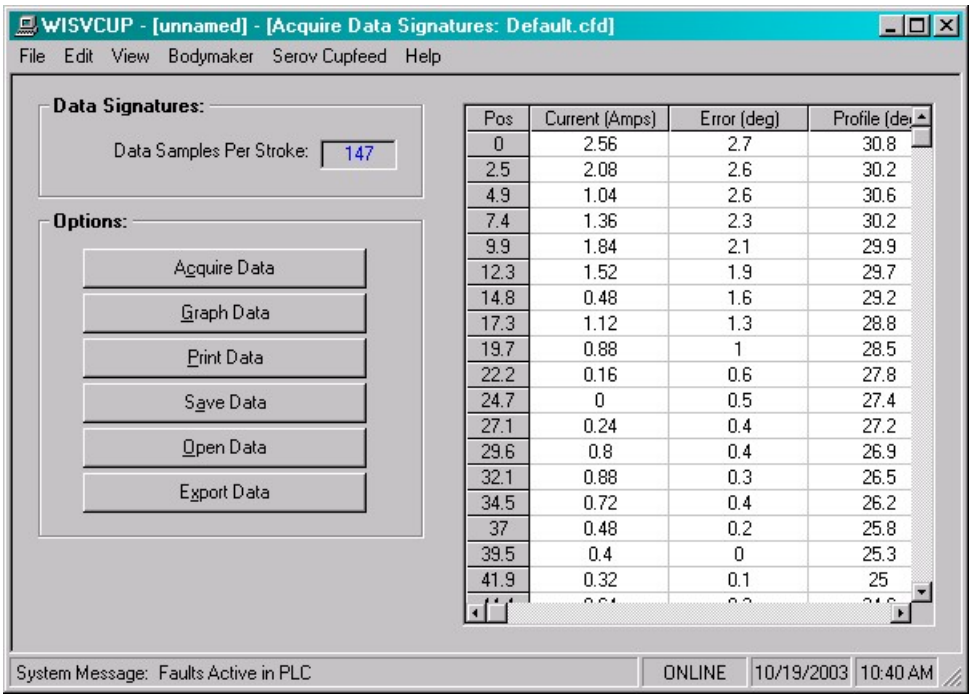
Cupfeed Cam Offset (0-4095): This is set automatically when the cupfeed is initially timed after power up and is calculated based on the "Cupfeed Home Position".

Cupfeed Cam Home Position: This is the position of the cupfeed cam when a cup is loaded into the cup locator. The cupfeed cam is timed such that it will be in sync with the main crank and load the cup when the ram has just opened up. The position is set when the user presses the "Home Cupfeed Cam" push-button inside the HSL-WISVCUP enclosure.

Main Crank-to-Cupfeed Absolute Error: This is the absolute (magnitude) difference between the main crank position and the cupfeed cam. When the PID servo loop is active, the torque applied to the cupfeed cam motor will be a function of this error.

4.6.3 THE ACQUIRE DATA SIGNATURES WINDOW

This selection is used to acquire the current, error, actual cam profile, and reference profile data for one stroke. This data is sampled once every millisecond for one complete stroke and uploaded from the processor. This is used for tuning while the machine is running as well as trouble-shooting.


WISVCUP - [unnamed] - [Acquire Data Signatures: Default.cfd]
File Edit View Bodymaker Serov Cupfeed Help
Data Signatures:
Data Samples Per Stroke: 147
Options:
Acquire Data
Graph Data
Print Data
Save Data
Open Data
Export Data
Pos | Current (Amps) | Error (deg) | Profile (de
0 | 2.56 | 2.7 | 30.8
2.5 | 2.08 | 2.6 | 30.2
4.9 | 1.04 | 2.6 | 30.6
7.4 | 1.36 | 2.3 | 30.2
9.9 | 1.84 | 2.1 | 29.9
12.3 | 1.52 | 1.9 | 29.7
14.8 | 0.48 | 1.6 | 29.2
17.3 | 1.12 | 1.3 | 28.8
19.7 | 0.88 | 1 | 28.5
22.2 | 0.16 | 0.6 | 27.8
24.7 | 0 | 0.5 | 27.4
27.1 | 0.24 | 0.4 | 27.2
29.6 | 0.8 | 0.4 | 26.9
32.1 | 0.88 | 0.3 | 26.5
34.5 | 0.72 | 0.4 | 26.2
37 | 0.48 | 0.2 | 25.8
39.5 | 0.4 | 0 | 25.3
41.9 | 0.32 | 0.1 | 25
System Message: Faults Active in PLC
ONLINE
10/19/2003
10:40 AM

The total number of samples taken in one stroke is equal to the period in milliseconds, up to a maximum of 255 samples. This value is displayed in the "Data Samples per Stroke" field.

The following functions can be executed from this window:

Acquire Data: By clicking this command button, the S4520 initiates collecting the data signatures for one stroke. Once completed, the data collected is displayed in the chart to the right.

Note: The "Acquire Data" function is only enabled when the set-up program is "Online" with the processor.

Print Data: By clicking this command button, the user can obtain a printout of the data displayed. Once executed, the "Print Setup" dialog box is displayed, allowing the user to choose a printer device, as well as, define the size and orientation of the paper. This printout also displays the current settings of the PID gains.

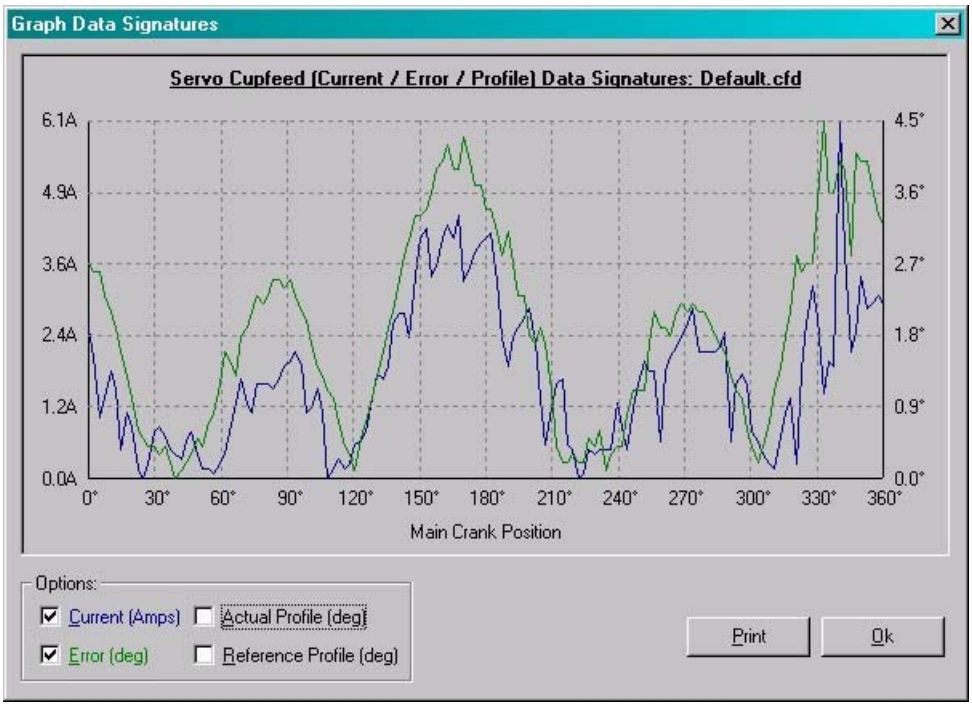
Save Data: By clicking this command button, the user can save the data to a "Cupfeed Data" file. This allows the user to easily save different sets of acquired data signatures.

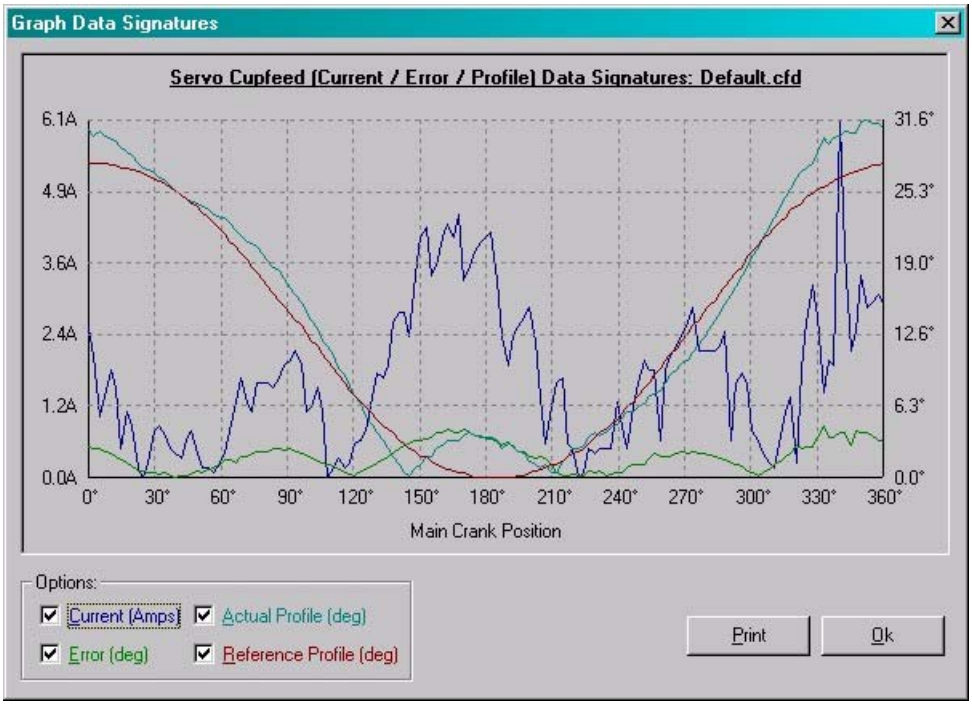
Open Data: By clicking this command button, the user can open an existing "Cupfeed Data" file. This allows the user to examine previously saved acquired data signatures, while not "Online" with the processor.

Export Data: By clicking this command button, the user can export the displayed data to a "Text" file format. This allows the data to be easily used by other windows programs such as Microsoft Excel or Microsoft Word. Any program that can open a "Text" file format, can have access to this data.

Note: Data displayed can also be copied to the windows clipboard. Simply select the desired data, press "Ctrl+C" and the data will be copied to the windows clipboard. The user can then open another windows program, such as Microsoft Excel, and paste the contents of the clipboard into the new worksheet.

Graph Data: By clicking this command button, the user is able to graph the acquired data. This function displays another window, allowing the user to graph the different data signatures against one another and obtain a printout of the graph. This printout also displays the current settings of the PID gains.





SECTION 4
WISVCUP - WINDOWS BASED
SET-UP PROGRAM REFERENCE

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SECTION 5
HSLSCUP - DOS BASED
SET-UP PROGRAM REFERENCE

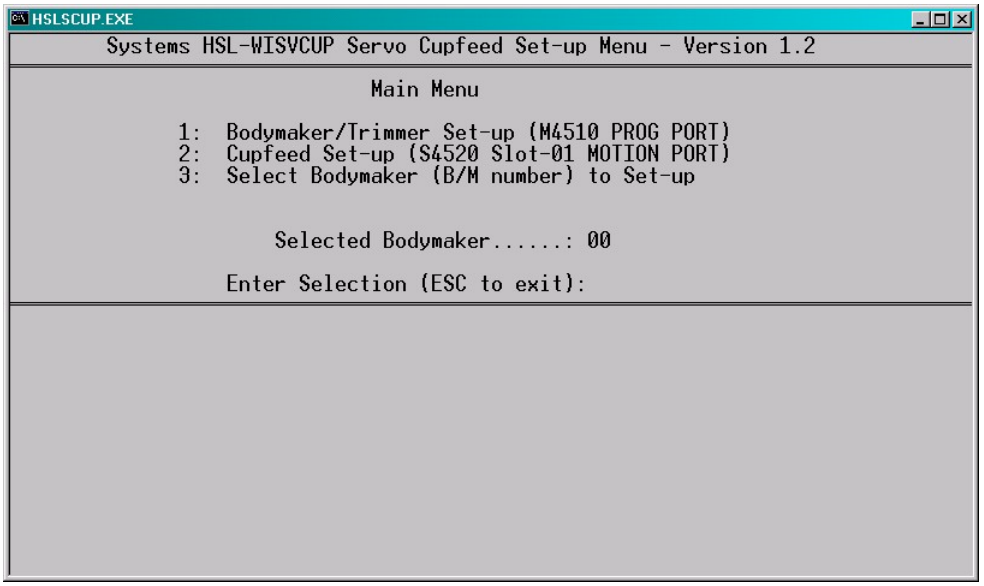
The DOS based "HSLSCUP" set-up program is a menu driven program that allows the user to easily view data or alter the set-up variables using a laptop or personal computer. In addition, the set-up program can be used to tune and test the cupfeed servo motor. The set-up variables are used to configure and tune the control system to match the configuration and performance of the specific bodymaker (see section 2.9 – HSL-WISVCUP Set-Up).

Note: The "HSLSCUP" program is an on-line communications program used to interface with the M4510 module and S4520 Motion Control board. The data displayed and set in the menus is communicated directly to the M4510 and S4520. Therefore, prior to selecting any of the menu selections, make sure an RS-232 cable is connected from the COM port to the respective port ("PROG" or "MOTION") port on the M4510.

The following sections are a complete description of the "HSLSCUP" setup program selections and menus.

5.1 MAIN MENU

The main menu of the "HSLSCUP" set-up program incorporates the following menu selections:


HSLSCUP.EXE
Systems HSL-WISVCUP Servo Cupfeed Set-up Menu - Version 1.2
Main Menu
1: Bodymaker/Trimmer Set-up (M4510 PROG PORT)
2: Cupfeed Set-up (S4520 Slot-01 MOTION PORT)
3: Select Bodymaker (B/M number) to Set-up
Selected Bodymaker.....: 00
Enter Selection (ESC to exit):

SECTION 5
HSLSCUP - DOS BASED
SET-UP PROGRAM REFERENCE

1: Bodymaker/Trimmer Set-up (M4510 PROG PORT)

This selection is used to interface with the main processor of the M4510. This includes:

- Set-up of the basic bodymaker and trimmer parameters (HSL-WI6 option).
- Downloading the application program to the M4510.
- Downloading/uploading the set-up data and saving these parameters on disk.

When selected, the "Bodymaker/Trimmer Set-Up Main Menu" is invoked (see section 5.2 – Bodymaker/Trimmer Set-Up Main Menu).

2: Cupfeed Set-up (S4520 Slot-01 MOTION PORT)

This selection is used to interface with the Cupfeed S4520 motion control processor in slot-01 of the M4510 chassis. This includes:

- Set-up of the cupfeed motion control parameters.
- Timing of the servo cupfeed motor.
- Tuning the servo cupfeed PID loop gains.
- Downloading the "SRVCUPR" application program to the S4520.
- Downloading/uploading the servo cupfeed parameters and saving these parameters on disk.

When selected, the "Cupfeed Set-up Main Menu" is invoked (see section 5.3 – Cupfeed Set-Up Main Menu).

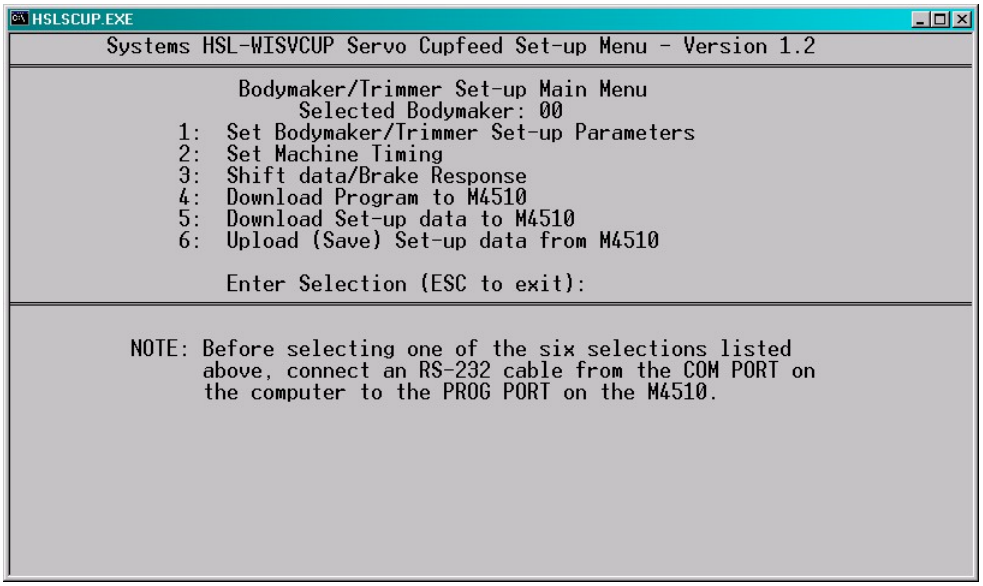
3: Select Bodymaker (B/M number) to Set-up

This selection is used to select the bodymaker that will be interfaced to. In most cases, the set-up parameters from one bodymaker to another bodymaker will vary depending on the actual performance of that bodymaker. This selection allows the setup program to interface with all the bodymakers in the plant, saving the set-up data for each bodymaker in separate files.

Note: Be sure to select the respective Bodymaker number prior to modifying any of the parameters (this should be the first step performed when the program is invoked). The data file for Bodymaker number 00 contains the recommended defaults for the HSL-WISVCUP package.

5.2 BODYMAKER/TRIMMER SET-UP MAIN MENU

The Bodymaker/Trimmer Set-up main menu of the set-up program incorporates the following menu selections:


HSLSCUP.EXE
Systems HSL-WISVCUP Servo Cupfeed Set-up Menu - Version 1.2
Bodymaker/Trimmer Set-up Main Menu
Selected Bodymaker: 00
1: Set Bodymaker/Trimmer Set-up Parameters
2: Set Machine Timing
3: Shift data/Brake Response
4: Download Program to M4510
5: Download Set-up data to M4510
6: Upload (Save) Set-up data from M4510
Enter Selection (ESC to exit):
NOTE: Before selecting one of the six selections listed
above, connect an RS-232 cable from the COM PORT on
the computer to the PROG PORT on the M4510.

Note: All the selections above with the exception of selection 4 are used with the HSL-WI6 option only. See the HSL-WI6 User's Manual for more details.

BODYMAKER/TRIMMER SET-UP MENU
4: Download Program to M4510

This selection is used to download the application program to the M4510 module. This should only be performed when replacing the module (see section 2.10.1 – M4510 Module Installation) or when the program has been changed.

Note: Program download cannot be performed while the bodymaker is running. All outputs on the M4510 are turned "off" and no program execution is performed. The bodymaker should therefore be stopped prior to program download.

This selection can also be used to verify the program ident, revision, and checksum without downloading the program. Perform steps 1 through 3 below but instead of initiating the download in step 3, simply press the <ESC> key to abort the download.

To download the program, perform the following:

1) Connect the RS-232 cable from the COM port on the computer to the "PROG" port on the M4510.

2) Select the "1: Bodymaker/Trimmer Set-up (M4510 PROG PORT)" selection from the HSL-WISVCUP Main Menu.

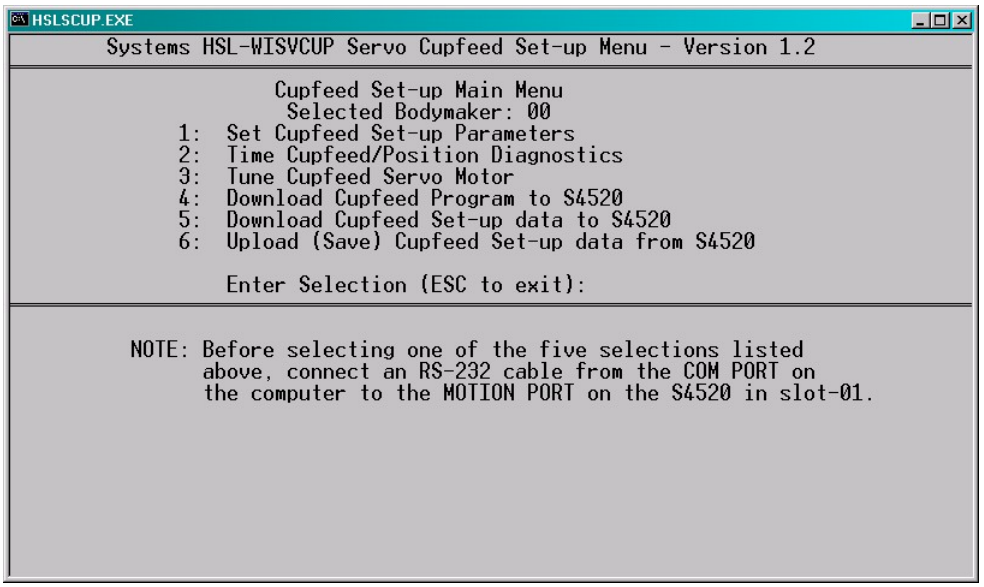
3) Select "4: Download Program to M4510". The current program ident, revision, and checksum for both the program on disk and already loaded in the module will be displayed. A prompt will be displayed asking to continue or abort. To continue, press any key except the <ESC> key. To abort, press the <ESC> key. If a prompt stating that the "HSLSCUP" file could not be open is displayed, then the "HSLSCUP" application program is not installed in the current directory.

4) Once program download is initiated, M4510 program execution will cease, the current address being downloaded will be displayed, and the "RUN" LED on the M4510 will flash continuously.

5) Once the download is complete, the "RUN" LED on the M4510 will illuminate solid and program execution in the M4510 will resume.

4.3 CUPFEED SET-UP MAIN MENU

The Cupfeed Set-up main menu of the "HSLSCUP" program incorporates the following menu selections:

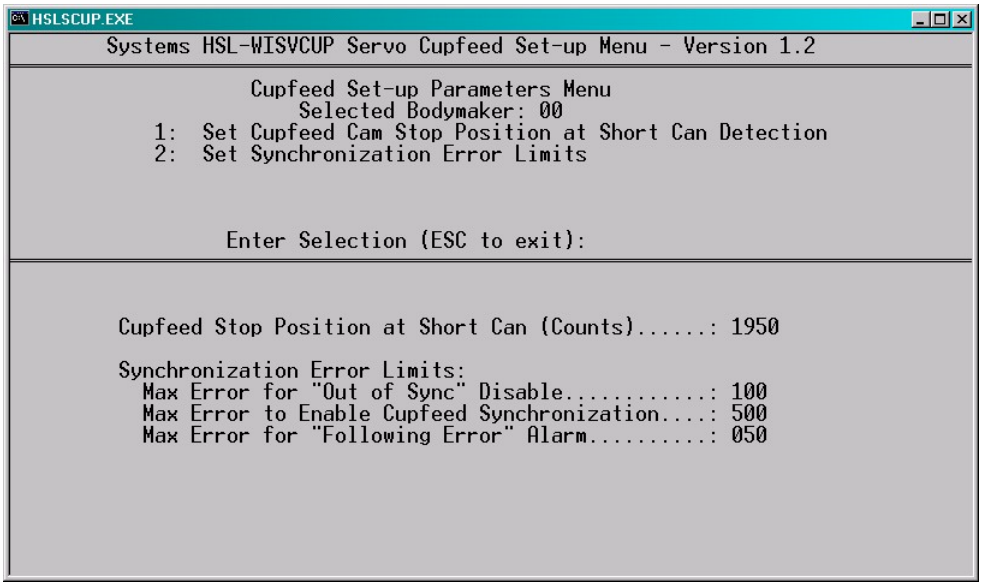

HSLSCUP.EXE
Systems HSL-WISVCUP Servo Cupfeed Set-up Menu - Version 1.2
Cupfeed Set-up Main Menu
Selected Bodymaker: 00
1: Set Cupfeed Set-up Parameters
2: Time Cupfeed/Position Diagnostics
3: Tune Cupfeed Servo Motor
4: Download Cupfeed Program to S4520
5: Download Cupfeed Set-up data to S4520
6: Upload (Save) Cupfeed Set-up data from S4520
Enter Selection (ESC to exit):
NOTE: Before selecting one of the five selections listed
above, connect an RS-232 cable from the COM PORT on
the computer to the MOTION PORT on the S4520 in slot-01.

Note: Prior to selecting this selection, make sure the RS-232 cable is connected from the COM port on the computer to the MOTION PORT on the S4520 in slot-01.

CUPFEED SET-UP MENU
1: Set Cupfeed Set-up Parameters

This selection is used to set the cupfeed set-up parameters. When selected, the "Cupfeed Set-up Parameters" menu is invoked.

The "Cupfeed Set-up Parameters" menu contains the following selections:


HSLSCUP.EXE
Systems HSL-WISVCUP Servo Cupfeed Set-up Menu - Version 1.2
Cupfeed Set-up Parameters Menu
Selected Bodymaker: 00
1: Set Cupfeed Cam Stop Position at Short Can Detection
2: Set Synchronization Error Limits
Enter Selection (ESC to exit):
Cupfeed Stop Position at Short Can (Counts)......: 1950
Synchronization Error Limits:
Max Error for "Out of Sync" Disable.....: 100
Max Error to Enable Cupfeed Synchronization....: 500
Max Error for "Following Error" Alarm.....: 050

The following selections set the corresponding parameters:

1: Set Cupfeed Cam Stop Position at Short Can Detection: Cupfeed Stop Position at Short Can (Counts): This is the position the cupfeed cam will stop at when a short can alarm occurs. This should be set to the trailing edge of the short can check timing signal such that when a short can is detected, the cupfeed cam will immediately stop (and not continue following the ram).

2: Set Synchronization Error Limits:

Max Error for "Out of Sync" Disable: This is the maximum amount of error allowed between the ram and the cupfeed to enable the cupfeed to open. If the running error is less than this threshold, the cupfeed is in sync with the ram and the cupfeed can be opened. If the running error is greater than this threshold, the cupfeed will be disabled.

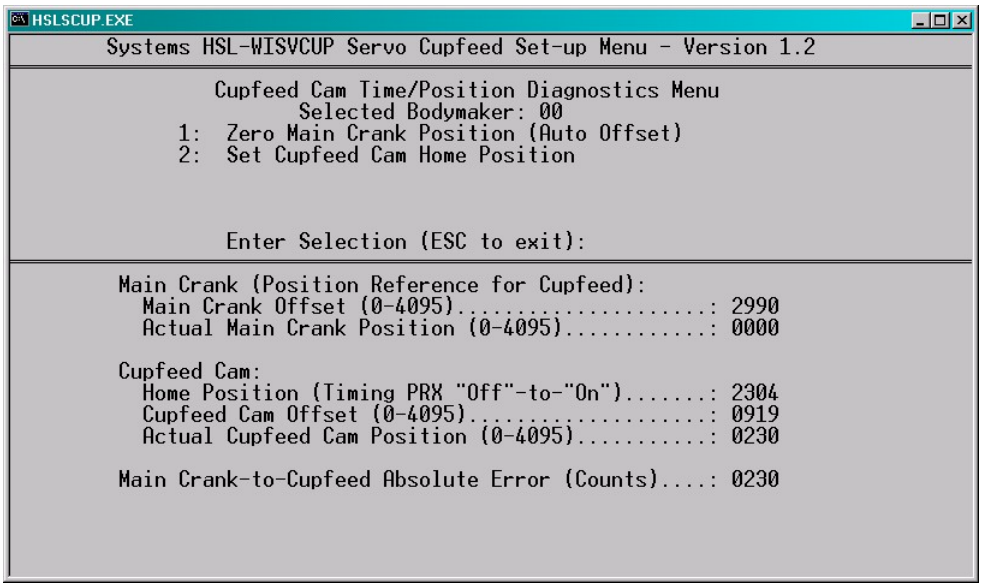
Max Error to Enable Cupfeed Synchronization: This threshold is used to synchronize the cupfeed with the main crank when the clutch is activated. Once the main crank is within this error threshold of the cupfeed, the cupfeed will than sync in with the main crank and then track the ram using the PID servo loop.

Max Error for "Following Error" Alarm: This is the maximum amount of error allowed between the ram and the cupfeed before a "Following Error" fault is generated. This is enabled once the cupfeed is in sync with the main crank. The "Following Error" alarm is filtered to allow short errors in excess of this threshold to occur without generating the alarm. This threshold is primarily used to detect instability in the cupfeed servo motor or peak current limit conditions (excessive frictional loads in the cupfeed).

CUPFEED SET-UP MENU
2: Time Cupfeed/Position Diagnostics

This selection is used to time the cupfeed and zero the main crank in the S4520 (slot-01). In addition, this menu displays the main crank position and servo cupfeed motor position. This is useful for trouble-shooting purposes.

The "Cupfeed Time/Position Diagnostics" menu contains the following selections:


HSLSCUP.EXE
Systems HSL-WISVCUP Servo Cupfeed Set-up Menu - Version 1.2
Cupfeed Cam Time/Position Diagnostics Menu
Selected Bodymaker: 00
1: Zero Main Crank Position (Auto Offset)
2: Set Cupfeed Cam Home Position
Enter Selection (ESC to exit):
Main Crank (Position Reference for Cupfeed):
Main Crank Offset (0-4095).....: 2990
Actual Main Crank Position (0-4095).....: 0000
Cupfeed Cam:
Home Position (Timing PRX "Off"-to-"On").....: 2304
Cupfeed Cam Offset (0-4095).....: 0919
Actual Cupfeed Cam Position (0-4095).....: 0230
Main Crank-to-Cupfeed Absolute Error (Counts)....: 0230

The following selections set the corresponding parameters:

1: Zero Main Crank Position (Auto Offset): This selection zeros the main crank position by calculating the required offset to make the current position zero. This would be done when a new S4520 board has been installed. To zero the main crank position, set the ram at Back Dead Center and select this selection. A prompt asking "are you sure?" is displayed. Press "Y" to zero the position, or "N" to abort. The "main crank offset" will be calculated and the "Actual Main Crank Position" will now read "0".

Note: Activating this selection will zero the main crank position in the S4520 (slot-01) only. The M4510 main crank position is not set from this selection. To set both simultaneously, zero the main crank position per section 2.9.4 – Set Main Crank Zero.

2: Set Cupfeed Cam Home Position: This selection is used to set the "Cupfeed Cam Home Position". This is the position of the cupfeed cam when a cup is loaded into the cup locator. The cupfeed cam is timed such that it will be in sync with the main crank and load the cup when the ram has just opened up. The position is set when the user presses the "Home Cupfeed Cam" push-button inside the HSL-WISVCUP enclosure.

In addition to the selections listed above, the following data is displayed in the menu:

Main Crank Offset: This is automatically set when the main crank position is zeroed.

Actual Main Crank Position (0-4095): This is the current main crank position with reference to a scale factor of 4096 for one complete revolution of the main crank. This is used as the primary reference for the cupfeed PID servo loop.

Cupfeed Cam Home Position: This is the position of the cupfeed cam when a cup is loaded into the cup locator.

Cupfeed Cam Offset (0-4095): This is set automatically when the cupfeed is initially timed after power up and is calculated based on the "Cupfeed Home Position".

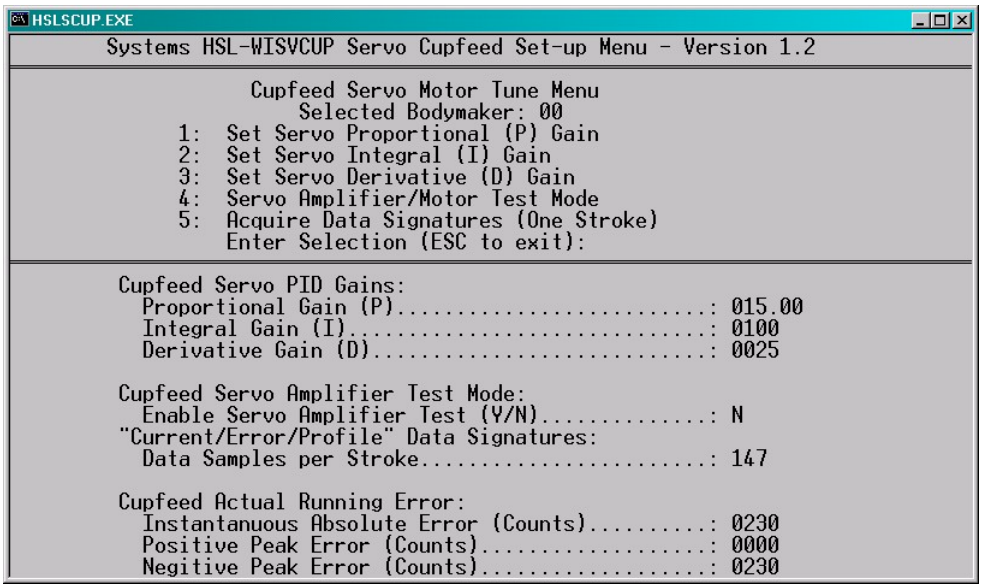
Actual Cupfeed Cam Position (0-4095): This is the current cupfeed cam position with a scale factor of 4096 for one complete revolution of the cupfeed cam. This is used as the feedback to the cupfeed PID servo loop.

Main Crank-to-Cupfeed Absolute Error: This is the absolute (magnitude) difference between the main crank position and the cupfeed cam. When the PID servo loop is active, the torque applied to the cupfeed cam motor will be a function of this error.

CUPFEED SET-UP MENU
3: Tune Cupfeed Servo Motor

This selection is used to tune the cupfeed motor.

The "Cupfeed Servo Motor Tune" menu contains the following selections:


HSLSCUP.EXE
Systems HSL-WISVCUP Servo Cupfeed Set-up Menu - Version 1.2
Cupfeed Servo Motor Tune Menu
Selected Bodymaker: 00
1: Set Servo Proportional (P) Gain
2: Set Servo Integral (I) Gain
3: Set Servo Derivative (D) Gain
4: Servo Amplifier/Motor Test Mode
5: Acquire Data Signatures (One Stroke)
Enter Selection (ESC to exit):
Cupfeed Servo PID Gains:
Proportional Gain (P)....: 015.00
Integral Gain (I)....: 0100
Derivative Gain (D)....: 0025
Cupfeed Servo Amplifier Test Mode:
Enable Servo Amplifier Test (Y/N)....: N
"Current/Error/Profile" Data Signatures:
Data Samples per Stroke....: 147
Cupfeed Actual Running Error:
Instantanuous Absolute Error (Counts)....: 0230
Positive Peak Error (Counts)....: 0000
Negitive Peak Error (Counts)....: 0230

The following selections set the corresponding parameters. See section 3 for details on tuning the PID servo loop.

1: **Set Proportional (P) Gain:** This is the proportional gain (torque proportional to error) of the PID servo loop.

2: **Set Integral (I) Gain:** This is the integral gain (torque proportional to cumulative error) of the PID servo loop.

3: **Set Derivative Gain (D):** This is the derivative gain (torque proportional to rate of change of error) of the PID servo loop.

4: Servo Amplifier/Motor Test Mode: When selected, the user is prompted to either enable or disable the servo amplifier/motor test mode. Enter "1" to enable or "0" to disable the step response test. If enabled, the servo amplifier test outlined in the trouble-shooting section 7.3 can be performed.

Note: This is only used to verify the servo amplifier and motor. The machine cannot be run with the test mode enabled. For this reason due caution must be used when performing this test.

WARNING: IN THE TEST MODE, THE SERVO MOTOR IS EXCLUSIVELY CONTROLLED WITH THE "TEST/OFFSET" (POT 4) ON THE B25A20. STAY CLEAR OF THE CUPFEED CAM AT ALL TIMES DURING THE SERVO AMPLIFIER TEST!!

5: Acquire Data Signatures (One Stroke): This selection is used to acquire the current, error, actual cam profile, and reference profile data for one stroke. This data is sampled every millisecond for one complete stroke, uploaded and saved in a text file. This file can be imported into an Excel worksheet and then viewed in a chart as well as scaled and summarized. This is used for tuning while the machine is running as well as trouble-shooting. The data is saved in the text file in four columns as follows:

Current Error Actual Profile Reference Profile

The total number of samples taken in one stroke is equal to the period of the stroke in milliseconds up to a maximum of 255 samples.

The text file created has the same file name as the program loaded into the S4520-RDC (default file name is "SRVCUPR") with the extension "TXT".

In addition to the selections listed above and the corresponding parameters set by these selections, the following diagnostic data is displayed in the "Cupfeed Servo Motor Tune" menu:

Instantaneous Absolute Error (Counts): This is the current instantaneous absolute (magnitude) difference between the main crank position and the cupfeed cam position.

Positive Peak Error (Counts): This is the maximum positive peak error detected as the cupfeed cam rotates. This is updated once every 1.5 seconds while the machine is running.

Negative Peak Error (Counts): This is the maximum negative peak error detected as the cupfeed cam rotates. This is update once every 1.5 seconds while the machine is running.

The above diagnostic error data can be used to judge how well the cupfeed cam motor is tuned and how well the cupfeed cam is tracking the main crank.

CUPFEED SET-UP MENU
4: Download Cupfeed Program to S4520

This selection is used to download the SRVCUPR application program to the S4520 in slot-01. This should only be performed when either replacing the S4520 in slot-01 or when the program has been changed. To download the program, perform the following:

Note: Program download cannot be performed while the bodymaker is running. Control of the Cupfeed servo motor ceases during program downloaded. The bodymaker should be stopped before the download takes place.

1) Connect the RS-232 cable from the COM port on the computer to the "MOTION" port on the S4520 in slot-01.

2) Select the "3: Cupfeed Set-up (S4520 slot-01 MOTION PORT)" selection from the HSL-WISVCUP Main Menu.

3) Select "4: Download Cupfeed Program to S4520". The current program ident, revision, and checksum for both the program on disk and already loaded in the board will be displayed. A prompt will be displayed asking to continue or abort. To continue, press any key except the <ESC> key. To abort, press the <ESC> key. If a prompt stating that the "SRVCUPR" file could not be opened is displayed, then the "SRVCUPR" application program is not installed in the current directory.

4) Once program download is initiated, S4520 program execution will cease, the current address being downloaded will be displayed, and the "RUN" LED on the S4520 will flash continuously.

5) Once the download is complete, the "RUN" LED on the S4520 will illuminate solid and program execution in the S4520 will resume. Press any key to return back to the "HSLSCUP" main menu.

6) This selection can also be used to verify the program ident, revision, and checksum without downloading the program. Perform steps 1 through 3 above but instead of initiating the download in step 3, simply press the <ESC> key to abort the download once the ident, revision, and checksum have been displayed.

CUPFEED SET-UP MENU
5: Download Cupfeed Set-up Data to S4520

This selection is used to download the previously uploaded (saved) cupfeed set-up variables for the currently selected Bodymaker to the S4520. This should only be performed when replacing the S4520 board in slot-01.

Note: This set-up data consists of the cupfeed set-up parameters only and not the bodymaker set-up data. To download the cupfeed set-up data, perform the following:

1) Connect the RS-232 cable from the COM port on the computer to the "MOTION" port on the S4520 in slot-01.

2) Select the "3: Cupfeed Set-up (S4520 slot-01 MOTION PORT)" selection from the HSL-WISVCUP Main Menu.

3) Select "5: Download Cupfeed Set-up data to S4520". A prompt will be displayed asking to continue or abort. To continue, press any key except the <ESC> key. To abort, press the <ESC> key.

4) Once data download is initiated, the current address being downloaded will be displayed.

5) Once set-up data download is complete, press any key to return to the "HSLSCUP" main menu.

CUPFEED SET-UP MENU
6: Upload (Save) Cupfeed Set-up Data from S4520

This selection is used to save the cupfeed set-up variables from the S4520 to the hard drive (current directory selected). This should be performed anytime any of the set-up variables have been changed.

Note: When the set-up variables are changed, they are changed directly in the S4520, not on the file in the computer.

By uploading (saving) the set-up variables to disk, they can be downloaded to the S4520 in the event the board must be replaced. The set-up data consists of the cupfeed set-up parameters for the currently selected Bodymaker.

To upload the set-up data, perform the following:

1) Connect the RS-232 cable from the COM port on the computer to the "MOTION" port on the S4520 in slot-01.

2) Select the "3: Cupfeed Set-up (S4520 slot-01 MOTION PORT)" selection from the HSL-WISVCUP Main Menu.

3) Select "6: Upload (Save) Cupfeed Set-up data from S4520". A prompt will be displayed asking to continue or abort. To continue, press any key except the <ESC> key. To abort, press the <ESC> key.

4) Once data upload is initiated, the current address being uploaded will be displayed.

   Note: The S4520 program execution is not ceased, therefore data upload can be performed while the machine is running.

5) Once set-up data upload is complete, press any key o return to the "HSLSCUP" main menu.

SECTION 5
HSLSCUP - DOS BASED
SET-UP PROGRAM REFERENCE

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SECTION 6
RECOMMENDED SPARE PARTS

The following are recommended spares for the HSL-WISVCUP. These parts are available through Systems Engineering Assoc., Inc.

Quantity	Part Number	Manuf.	Description
1ea.	M4510	SEG	PLC/PLSProcessor/Chassis
1ea.	P4500	SEG	SEG Power Supply
1ea.	S4520-RDC	SEG	Motion Control CO-CPU (Resolver)
1ea.	S4568	SEG	8 input/8 output 10-30VDC I/O Board
1ea.	B25A20	AMC	Brushless Servo Amplifier(12 Amp)
1ea.	PS300W-96V	SEG	300 Watt Power Supply
2ea.	SH04.31-NSW	AEG	Positively Guided Relay

Manufacturers Index:

SEG	Systems Electronics Group, Inc.
CSM	Custom Servo Motor, Inc.
AMC	Advanced Motion Controls, Inc.

SECTION 6
RECOMMENDED SPARE PARTS

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SECTION 7
TROUBLE-SHOOTING

The following is provided as a quick reference to aid in the troubleshooting of the HSL-WISVCUP. Typical faults include: cups not loading properly, cupfeed cam does not move, cupfeed cam oscillates wildly or jerks when attempting to follow the main crank, etc.. The following is a general trouble-shooting procedure which should minimize the time to determine the source of the fault.

7.1 CUPS DO NOT LOAD PROPERLY

If the cupfeed cam appears to track the main crank correctly but cups do not load properly, most likely the cupfeed cam is out of time. Perform the following:

1) Verify the main crank zero (see section 2.9.4).

2) Time the cupfeed cam to the main crank (see section 2.9.6).

3) Cupfeed timing sensor may have failed causing the cupfeed cam to only turn slowly (see section 7.2 below).

7.2 CUPFEED CAM ONLY TURNS SLOWLY WHEN MACHINE IS STROKED

If the cupfeed cam only turns slowly when the clutch is activated and never syncs in with the main crank, then most likely the cupfeed timing sensor has failed. Replace the cupfeed timing sensor and try again. If problem persists, verify the wiring from the sensor to the HSL-WISVCUP enclosure (see schematic).

7.3 CUPFEED CAM DOES NOT MOVE (Motor stalled, jerks, or oscillates)

Any number of faults can account for a failure of the cupfeed cam to move, jerk or oscillate. Prior to replacing any components, perform the following:

Verify the Problem:

1) Disconnect the Cupfeed Timing sensor cable from the Cupfeed Timing sensor.

2) With the guards closed (C1 contactor "on"), press the "Home Cupfeed Cam" push-button inside the HSL-WISVCUP enclosure.

3) The cupfeed cam should smoothly rotate forward about 2 revolutions slowly for about 5 seconds in an attempt to time itself. After two revolutions, it will stop on a "following fault". This process is normal and indicates that the servo system (servo motor, amplifier, cables, etc.) is functioning correctly. The "following fault" at the end of the two revolutions simply indicates that the timing sensor was never located. It is not necessary to perform the following steps if this is the case. Instead, perform the steps in section 7.4.

4) If, on the other hand, a "following fault" is detected immediately (without making the two revolutions) once the "Home Cupfeed Cam" push-button is pressed (the motor may jerk forward or backwards or may not move at all), then a problem does exist in the servo system. Perform the following steps to isolate the problem.

Verify HSL-WISVCUP Installation:

5) Verify power is applied to enclosure and that CB1 is not tripped or none of the fuses are blown.

6) Verify that "PWR" and "RUN" LEDs on M4510 and S4520-RDC are "on" and "FLT" LED is "off".

7) Verify all inputs from existing system (clutch "on", Run mode, alarm reset, and CRA/CRB/CRC safety (circuits) to HSL-WISVCUP function correctly.

8) Verify that the M4510 and S4520-RDC are loaded with the correct programs (see section 2.10.4 and 2.10.5).

9) Verify dip switches on S4520-RDC and S4568 are set correctly (see section 2.10.1).

10) Verify PID gains are set correctly (see section 2.9.1).

11) Verify dip switches on B25A20 amplifier are set correctly (see section 2.10.3).

12) Verify "Current Limit" POT and "Reference In" POT on B25A20 are turned fully **clockwise** (at least 14 turns or until stop in pot clicks) for maximum gain.

13) Verify "Loop Gain" POT on B25A20 is turned fully **counter-clockwise** (at least 14 turns or until stop in POT clicks) for minimum loop gain.

14) Verify all field wiring connectors to M4510, S4520-RDC, S4568, and B25A20 are installed in the correct location and fully seated (see schematic).

15) Verify stator wiring at cupfeed cam motor terminals and C1contactor are tight and are correct (see schematic).

Note: The stator wiring must be connected exactly as shown on the schematic, any other combination of connections will cause the motor either to jerk or stall .

16) Verify the resolver feedback wiring (at the cupfeed cam motor terminals and connector in HSL-WISVCUP enclosure) are tight and wired correctly (see schematic).

Note: The resolver feedback wiring must be connected exactly as shown on the schematic, any other combination of connections will effect the motor commutation and cause the motor to stall, jerk, or oscillate.

17) Verify the main crank resolver reference wiring connections (see schematic).

18) Verify resolver reference signal for servo motor is correct by measuring the voltage between R1 and R2 on the S4520-RDC using a DVM (see schematic). This can be measured between the ORG and WHT wires on the UMSTBHK connector on the upper left corner of the HSL-WISVCUP back-panel. The voltage should read 3.7Vrms.

Note: The frequency of this signal is 2500HZ. For this reason, some DVM's may read this voltage slightly low.

19) Verify resolver reference signal for the main crank is correct by measuring the voltage between R1 and R2 on the M4510 using a DVM. This should be measured between the R1 and R2 terminals on the 8-pin resolver connector on the M4510. The voltage should read 1.45Vrms.

Note: The frequency of this signal is 2500HZ. For this reason, some DVMs may read this voltage slightly low.

20) Verify the cupfeed cam and main crank resolvers (see sections 2.9.3 and 2.9.5).

Commutation Test:

Note: Make sure the C1 contactor is "off" (guards open) through-out the following test.

21) With the C1 contactor "off" (guards open), jumper 210 to 211 on the N.O. contact of C1.

22) With the C1 contactor "off" (guards open), enable the "Servo Amplifier/Motor Test" by performing the following:

a) Invoke the "HSLSCUP" setup program
b) Select "2: Cupfeed Set-up (S4520 Slot-01)"
c) Select "3: Tune Cupfeed Servo Motor"
d) Select "4: Servo Amplifier/Motor Test Mode"
e) "Enable Servo Test Mode" = 1 (enable)
f) "Are you sure" = 1

This enables the B25A20 Amplifier. The LED on the amplifier should be "green".

23) Rotate the cupfeed cam one revolution by hand and verify that the LED on the B25A20 stays "green" the entire revolution. If it turns "red" at any time during the revolution, the commutation is not correct. If it stays "green" through the entire revolution, the commutation (HALL signals from the S4520-RDC are OK).

24) Disable the "Servo Amplifier/Motor Test" mode by performing the following:

a) Select "4: Servo Amplifier/Motor Test Mode"
b) "Enable Servo Test Mode" = 0 (disable)

The LED on the B25A20 should be "red".

25) Remove the jumper between 210 and 211 on the C1 contactor N.O. contact.

Servo Amplifier/Motor Test:

WARNING!!

IN THE SERVO AMPLIFIER/TEST MODE, THE SERVO MOTOR IS CONTROLLED EXCLUSIVELY BY THE "TEST/OFFSET" POTENTIOMETER ON THE B25A20 AMPLIFIER. STAY CLEAR OF THE CUPFEED CAM AND SERVO MOTOR AT ALL TIMES WHILE PERFORMING THIS TEST!!

26) With the "Servo Amplifier/Motor Test" disabled, turn the C1 contactor "on" (close guards).

27) Enable the "Servo Amplifier/Motor Test" by performing the following:

a) Select "4: Servo Amplifier/Motor Test Mode"
b) "Enable Servo Test Mode" = 1 (enable)
c) "Are you sure" = 1

This enables the B25A20 Amplifier. The LED on the amplifier should be "green".

28) The servo motor should run proportional to the "Test/Offset" (pot4) on the B25A20.

29) The motor is running in an open loop torque mode but should run smoothly either forward or backwards depending on which way the "Test/Offset" pot is turned. The motor should also be able to be stopped by nulling out the pot.

30) If the motor does not run smoothly (jerking or running out of control), either something is wrong with the motor stator wiring, the motor, or the amplifier.

31) When done with the test, null the "Test/Offset" (pot 4) out such that the motor is stopped.

32) Disable the "Servo Amplifier/Motor Test" mode by performing the following:

a) Select "4: Servo Amplifier/Motor Test Mode"
b) "Enable Servo Test Mode" = 0 (disable)

The LED on the B25A20 should be "red".

Servo Motor Stator Windings Check:

33) If the Servo Amplifier/Motor test is not passed, verify the motor stator windings as follows:

a) With the C1 contactor "off" (guards open), measure the impedance of the R, S, and T stator windings against each other at the T1, T2, and T3 terminals of the C1 contactor. The impedance from any stator to any other stator should be ~6 ohms.

b) If any stator to any other stator is open, then measure the impedance of the stators to each other at the R, S, and T terminals inside the motor. If these measure OK, then one of the leads of the cable from C1 to the motor is bad. If the measurements at the motor terminals are not OK, the motor itself is bad.

c) If the stator-to-stator readings check out OK, then measure the impedance from each stator to ground. These should read as an open. If this is not the case, disconnect the motor leads at the motor and read the impedance from each stator to ground at the motor terminals. If these read OK, the cable from the C1 contactor to the motor is bad. If the readings are not OK, the motor itself is bad.

B25A20 Servo Amplifier Check:

34) If the motor stator windings check out OK, verify the B25A20 amplifier is functional as follows:

a) Re-activate the motor as was done in steps (26) through (29). With the motor stalled at a specific location, measure the DC voltage on all three stators (the VDC range on this check is 100VDC). Two of the three stators should have some DC voltage (these may be anywhere between 5 to 100 volts and may vary significantly), while one stator should essentially have no voltage.

b) Disable the motor (C1 contactor "off") and move the cam 180 degrees or so. Re-activate the motor again and measure the stator voltages. The stator that had no voltage on the previous reading should now read some DC voltage while one of the other stators no longer reads a voltage.

c) This test verifies that all three stators are driven by the amplifier and thus if voltage can be read at each stator at some position of the cam, the amplifier is OK.

Note: Only two stators are driven at a time. Therefore, the cam will have to move to different positions to verify that each stator is active at some position.

d) If this test checks out OK, then most likely the motor is bad. Replace the motor and retry the Servo Amplifier/Motor test (steps (26) through (32).

7.4 CUPFEED CAM DOES NOT TRACK PROPERLY (Intermittent following faults, high running errors)

Any number of problems can account for a failure of the cupfeed cam to track properly. Intermittent following faults and high running errors (positive or negative peak errors greater than 40) are due to a change or variation in the load (thus changing the required tuning of the system). This is generally due to a mechanical problem (incorrect belt tension, worn or damaged cupfeed cam bearing or motor bearing, etc.). Prior to replacing any components, perform the following:

1) Verify PID gains are set correctly (see section 2.9.1).

2) Verify dip switches on B25A20 amplifier are set correctly (see section 2.10.3).

3) Verify "Current Limit" POT and "Reference In" POT on B25A20 are turned fully clockwise (at least 14 turns or until stop in pot clicks) for maximum gain.

4) Verify "Loop Gain" POT on B25A20 is turned fully counter-clockwise (at least 14 turns or until stop in POT clicks) for minimum loop gain.

5) Verify all field wiring connectors to M4510, S4520-RDC, S4568, and B25A20 are installed in the correct location and fully seated (see schematic).

6) Verify stator wiring at cupfeed cam motor terminals and C1contactor are tight and are correct (see schematic).

   Note: The stator wiring must be connected exactly as shown on the schematic, any other combination of connections will cause the motor either to jerk or stall.

7) Verify the resolver feedback wiring at the cupfeed cam motor terminals and connector in HSL-WISVCUP enclosure are tight and are correct (see schematic).

   Note: The stator wiring must be connected exactly as shown on the schematic, any other combination of connections will cause the motor either to jerk or stall.

8) Verify the main crank resolver reference wiring connections (see schematic).

9) Verify resolver reference signal for servo motor is correct by measuring the voltage between R1 and R2 on the S4520-RDC using a DVM (see schematic). This can be measured between the ORG and WHT wires on the UMSTBHK connector on the upper left corner of the HSL-WISVCUP back-panel. The voltage should read 3.7Vrms.

   Note: The frequency of this signal is 2500HZ. For this reason, some DVMs may read this voltage slightly low.

10) Verify resolver reference signal for the main crank is correct by measuring the voltage between R1 and R2 on the M4510 using a DVM. This should be measured between the R1 and R2 terminals on the 8-pin resolver connector on the M4510. The voltage should read 1.45Vrms.

    Note: The frequency of this signal is 2500HZ. For this reason, some DVMs may read this voltage slightly low.

11) Verify the cupfeed cam and main crank resolvers (see sections 2.9.3 and 2.9.5).

12) Verify the tension on the cupfeed cam belt. If the belt is too loose the cam will oscillate which causes the following faults. If it is too tight, the cupfeed cam bearing will wear prematurely causing a variation in the load and thus oscillation and following errors.

13) Check the cupfeed cam belt for damage or wear. Replace if necessary.

14) Check the cupfeed cam bearing. Excessive belt tension or coolant spray can cause premature wear or damage to the bearing resulting in oscillation and following faults. Replace cupfeed cam bearing if necessary.

15) Check the servo motor bearing. Again excessive belt tension or coolant spray can cause premature wear or damage. Replace servo motor if necessary.

APPENDIX A
PLC PROGRAM
MODIFICATIONS EXAMPLE

The following ladder logic is generalized example showing how the PLC logic of the existing control system PLC should be modified to interface with the HSL-WISVCUP package.

Note: The following is merely suggested logic and may not accurately represent the logic of the existing system. It is the ultimate responsibility of the end user to ensure that the HSL_WISVCUP is interlocked with the existing system properly.

The variables shown in the ladder logic are defined as follows:

```
F000   -   F001: Internal coil of existing PLC.
X0.0   -   X0.5: Existing Inputs to Existing PLC.
B100.2 - B100.4: New Outputs between existing PLC and
                 HSL-WISVCUP package.
```

****

This block shows the additional mode interlocks from the existing control system to the HSL-WISVCUP that are required. These rungs should be added to the existing PLC logic.

In addition to the rungs shown, the "Machine RUn Enable" output (B101.0) from the HSL-WISVCUP should be added as an input to the existing PLC logic and interlocked to the BDC stop logic. When B101.0 in "ON" the machine is enabled to run, when it is "off", the machine should be stopped at BDC.

The "Cupfeed Cam in Sync" output (B101.5) from the HSL-WISVCUP should also be added as an input and interlocked with the cupfeed snable logic. When B101.5 is "off", the cupfeed cam is not in sync with the ram and the cupfeed should be closed, when B101.5 si "ON", the cupfeed cam is in sync with the ram and the cupfeed can be opened when other conditions permit.

Outputs B101.1 thru B101.4 are alarm conditions that can also be added as inputs to the existing PLC logic to indicate the cupfeed cam fault if desired. Activation of any one of these alarms will turn the "Machine Run Enable" output (B101.0) "off".

APPENDIX A
PLC PROGRAM
MODIFICATIONS EXAMPLE